The NATIONAL GEOGRAPHIC MAGAZINE

Vol. XVIII JUNE, 1907 No. 6

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OUR FISH IMMIGRANTS

ILLUSTRATED

By Dr Hugh M. Smith, Deputy Commissioner, U. S. Bureau of Fisheries

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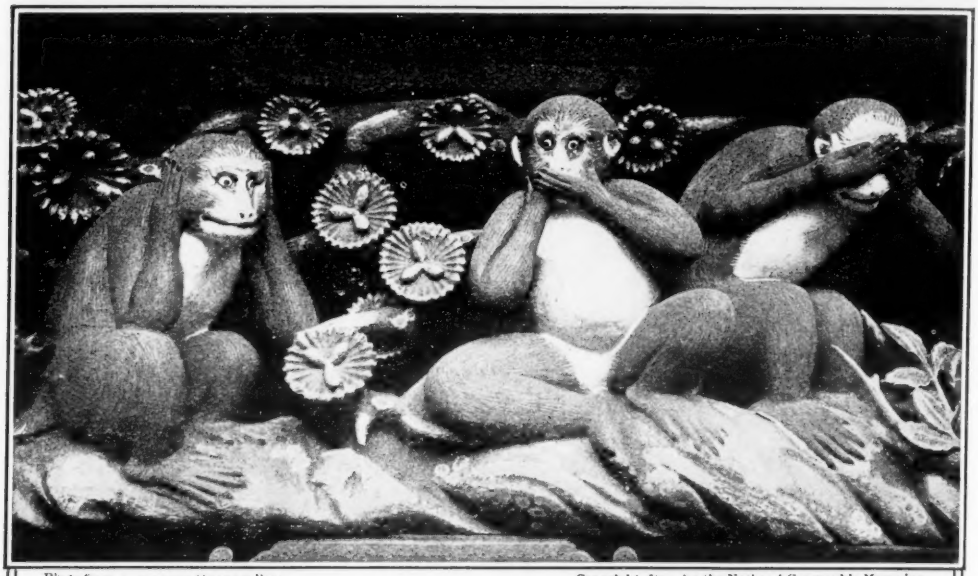

Photo from ALEXANDER GRAHAM BELL.

This Group of Monkeys Represents a Favorite Maxim of the Japanese:
"See No Evil, Speak No Evil, Hear No Evil."

SCENES FROM EVERY LAND

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VOL. XVIII, No. 6 WASHINGTON JUNE, 1907

THE NATIONAL GEOGRAPHIC MAGAZINE

BIGHORN MOUNTAINS

BY N. H. DARTON

OF THE UNITED STATES GEOLOGICAL SURVEY

ONE of the least-known portions of the Rocky Mountain province is the high outlying range known as the Bighorn Mountains. It extends north and south across the northern-central portion of Wyoming, a rugged barrier lying between the Great Plains on the east and a wide valley, known as Bighorn Basin, on the west. Its length is about 120 miles and the width varies from 30 to 50 miles. The higher summits rise over 13,000 feet above sea-level, or about 9,000 feet higher than the adjoining plains. The mountains lie some distance from the main lines of travel, the nearest railroad being the Burlington, which passes 20 miles east of them in the vicinity of Sheridan, Wyoming. Owing to their height and northern latitude, they are extensively snow-covered, much of the snow remaining on the higher summits throughout the summer. Several small glaciers lie in the shadow of the higher peaks. During the Glacial epoch they were covered with wide-spread fields of ice, of which the present glaciers are shrunken remnants. To the geologist these mountains present many phenomena of great interest. To the sightseer and Alpine climber many of their rugged features will prove most attractive. Game is abundant and most of the streams are teeming with trout. There is no hot weather, for the summers are cool by day and cold by night.

The mountains are due to a great uplift in the earth's crust, an arch whose crest has been truncated by erosion, leaving an elevated central area of old granite, with high flanking ridges of overlying sandstones and limestones. The arch is beautifully defined by the eastward dip of the strata on the east side of the range and the westward dip on the west side, features which are well exhibited in high cliffs in many of the deep canyons which cross the front range. The central area of granite presents considerable variety of scenery. The lower portions contain numerous parks covered with grass and various herbs which afford exceptionally fine pasturage, and during the summer season these are occupied by sheep and cattle. The parks are separated by numerous rocky ridges of granite, and a wide area from 6,000 to 10,000 feet in altitude is covered with forests of pine. Much of the main divide rises above 10,000 feet and presents high, rough mountain summits with surfaces either of loose granite blocks, or steep cliffs. This district culminates in Cloud

Peak, which has an altitude of 13,165 feet. At this peak and in its vicinity there is some of the wildest Alpine scenery in America. There are numerous cliffs and pinnacles over a thousand feet high, with great variety of form and in part inaccessible. Representative views of this area are given on pages 359 to 361.

On the east side of Cloud Peak there is a cirque with vertical walls 1,100 feet high, containing in its lower portion a true glacier. This body of ice is several hundred feet thick, over a half mile in length, and it has developed a well-defined terminal moraine. A view of its top is shown on page 359. Other similar glaciers occur in deep cirques north of Cloud Peak. The topography in this area presents strongly marked characteristics of glacial origin. The higher mountain slopes are deeply trenched by profound cirques which descend into U-shaped valleys, with numerous lake basins excavated in the granite. Some of these features are shown on pages 359 and 360. Over 70 well-defined cirques are exhibited in the Cloud Peak region. Most of them are in area shown on map, page 357. Some of the notable features in this area have been described by Mr F. E. Matthes, who has also discussed their origin.* Cloud Peak can be ascended only by the spur which leads up to it from the southwest.

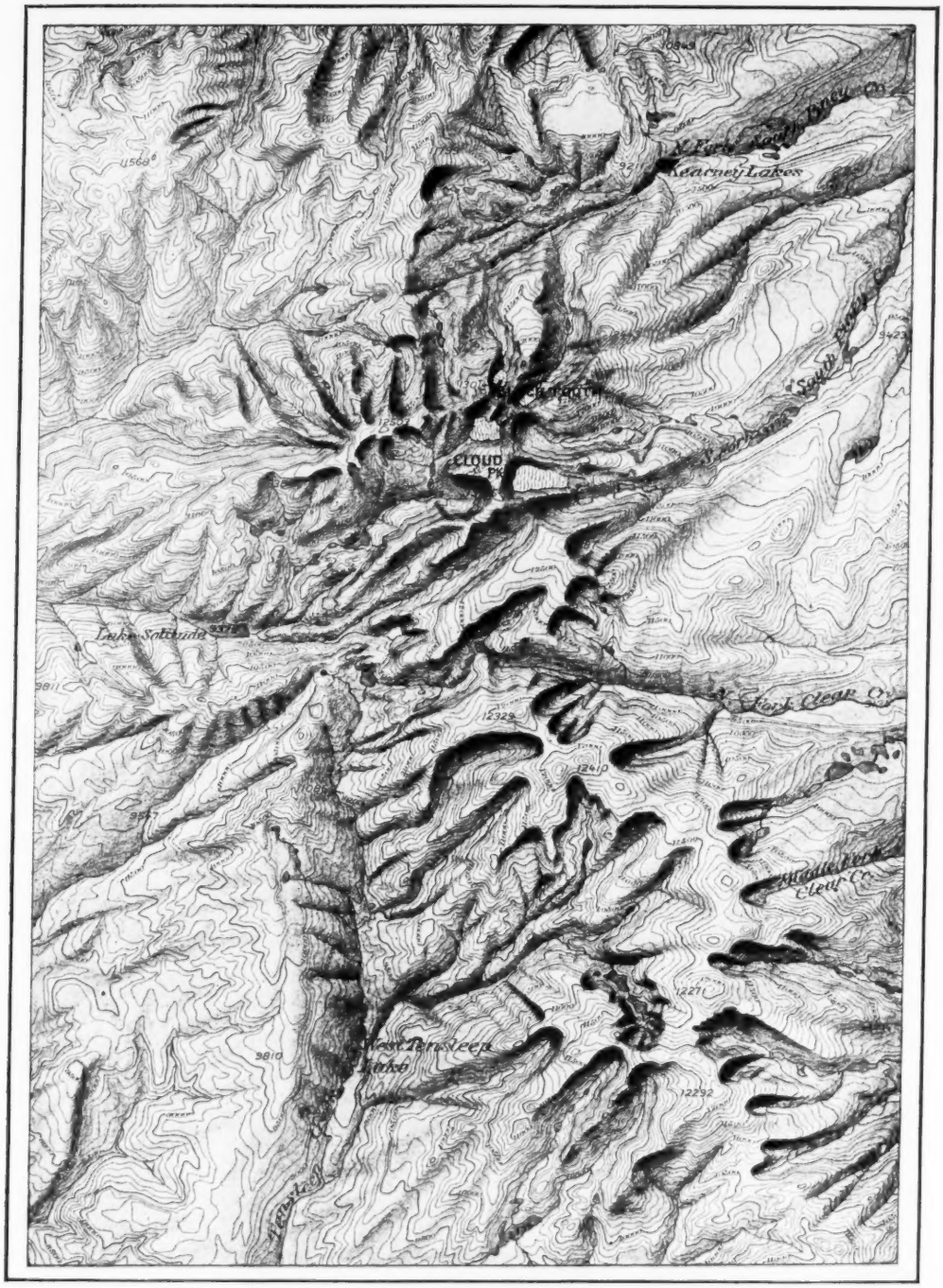
Numerous streams heading in the Bighorn Mountains carry large volumes of water into the adjoining plains region, where the water is extensively utilized for irrigation. These streams are fed by moderately heavy rainfall, and especially by the melting of snow, which continues throughout the summer. Water is the most important element derived from the mountains, for it sustains a population of considerable size in the adjacent lower lands. The mountain pastures are also an important feature, affording sustenance for a large number of cattle and sheep during four or five months. Not only is the feed excellent in quality but the high mountain climate is especially favorable for the animals.

The forests of the highlands have been placed in a government reserve, but before this was done they had been cut to some extent and deeply invaded by fires. The timber is mostly of moderate size and useful principally for railroad ties. In the northern portion of the range a large number of ties have been cut and floated down the canyon of Tongue River in a flume, some features of which are shown on page 362. The flume is 17 miles long and in part is carried on trestles varying in height from 6 to 90 feet. At a few points it was necessary to drive tunnels through spurs of rock. About 2,000,000 ties have been floated down this flume.

The mineral resources of the Bighorn Mountains do not appear to be particularly promising, although some of the higher areas have not yet been thoroughly prospected. A few gold and copper leads have been found, but they have given but little encouragement for further development. A moderate amount of gold-bearing gravel occurs in the northern portion of the range; it was worked to some extent by a jigging machine, but the product was not large. Very large deposits of gypsum occur in the Red beds lying along the foot of the mountains, and in the vicinity of Sheridan and Buffalo, in the adjoining plains, there are extensive deposits of lignite coals which have proven valuable.

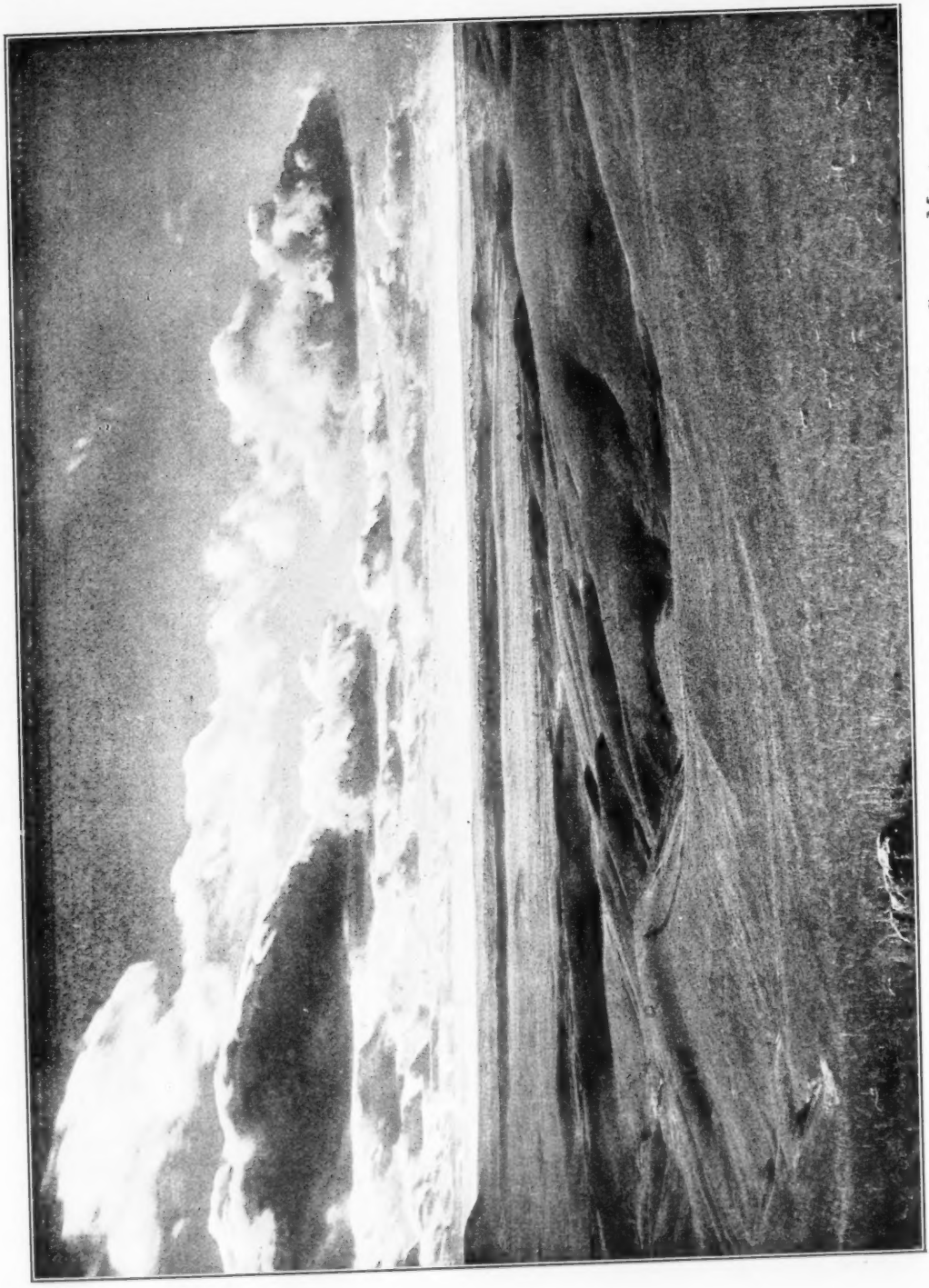
Maps and descriptions of the geology of the Bighorn Mountains by N. H. Darton have recently been issued by the U. S. Geological Survey as folios Nos. 141 and 142.

*Glacial Sculpture of the Bighorn Mountains, Wyoming. U. S. Geological Survey, 21st Annual Report, part 2, p. 167.

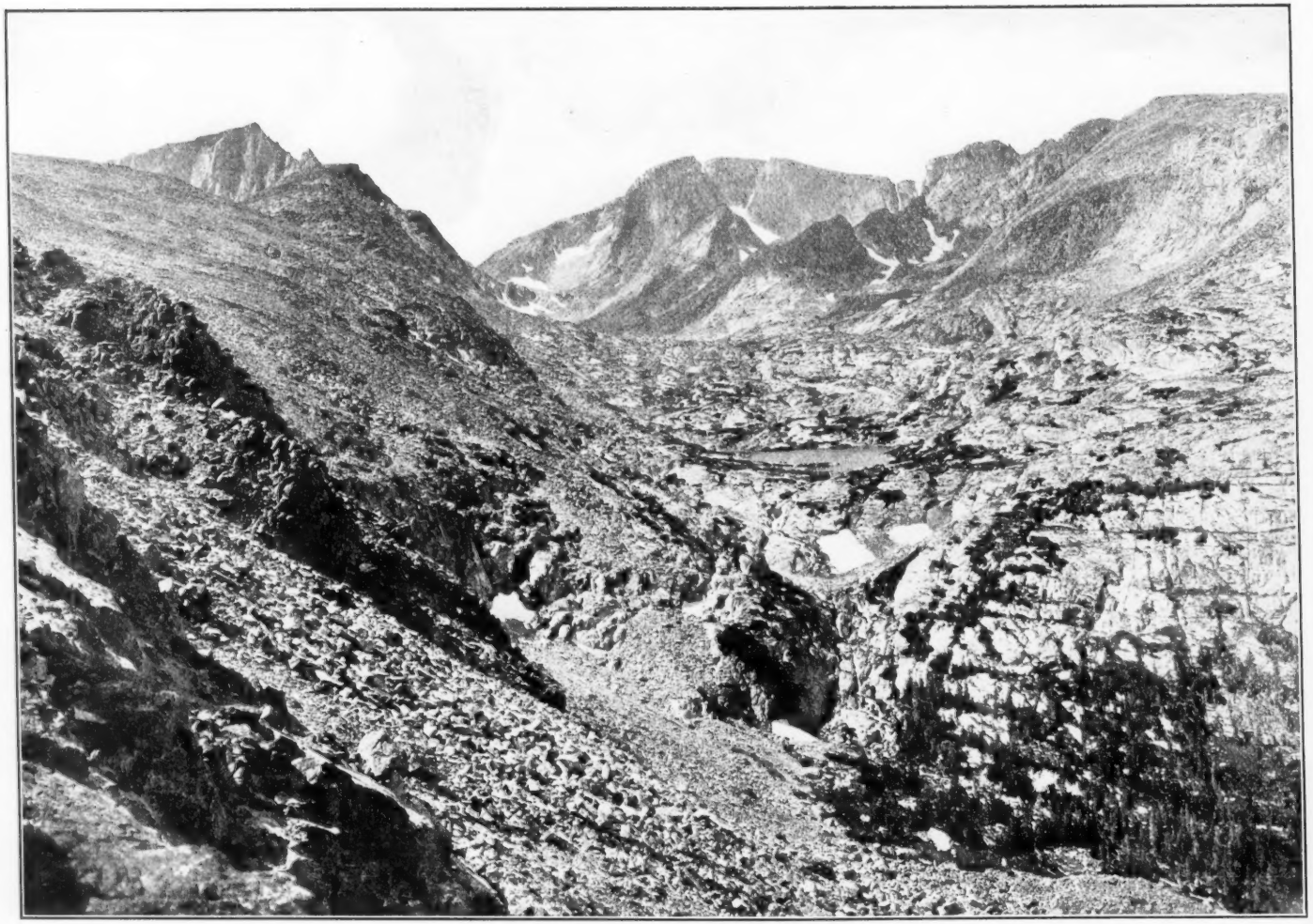


Topographic Map of the Cloud Peak Region, Summit of Bighorn Mountains, Wyoming

From Cloud Peak quadrangle, U. S. Geological Survey, by F. E. Matthes. The cirques are shown by shading; the glaciers by vertical waving lines; contour interval, 100 feet. Scale 3 miles to 1 inch. Note the many lofty peaks crowded into such a small area



Looking Northwest Across the Great Plains from the Mouth of the Bighorn Canyon, Montana

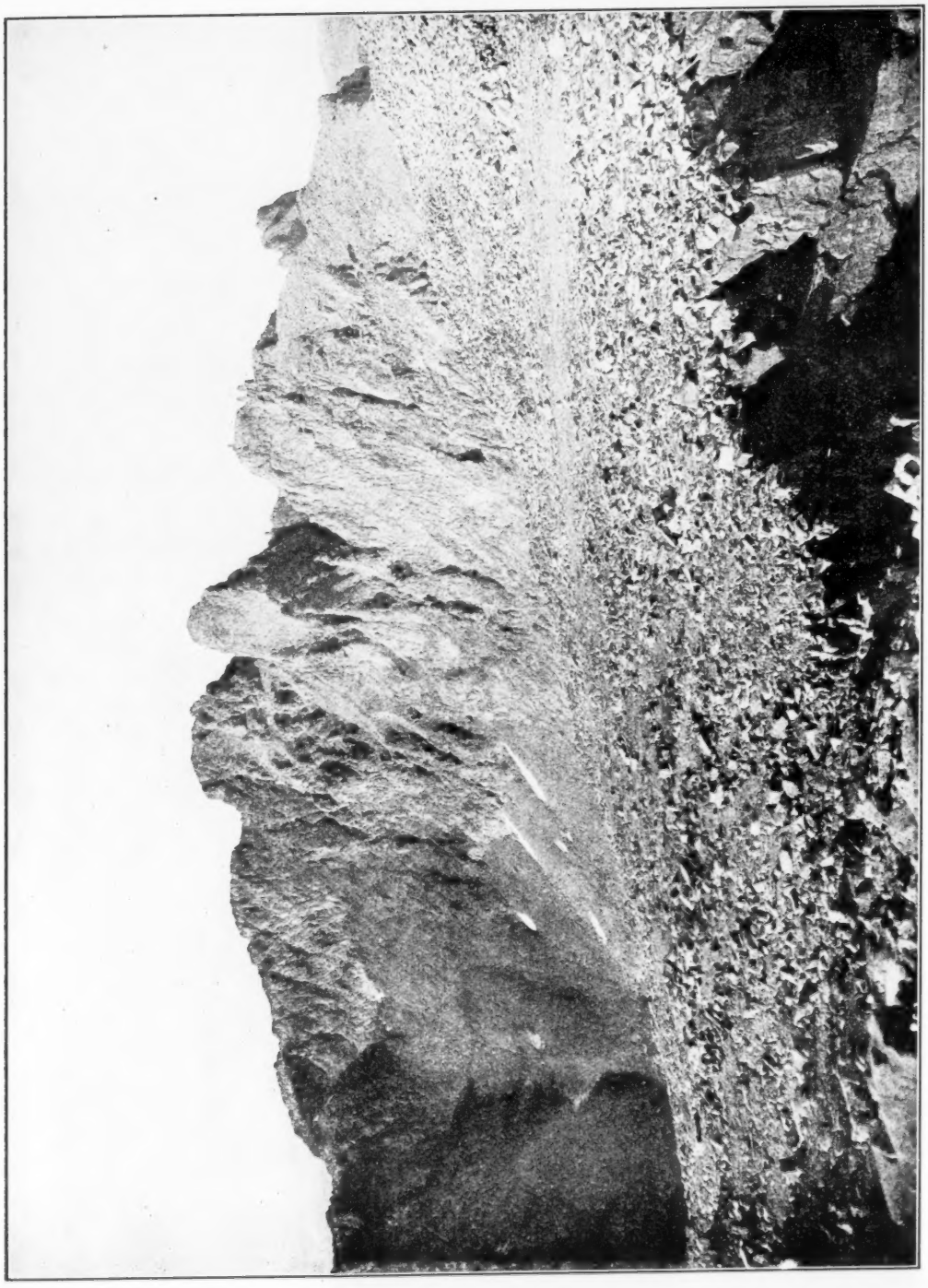


Cloud Peak from the East

The peak lies slightly to the right of the center. The cirques and U-shaped valley were carved out of the granite by former glaciers

Cloud Peak, the Culmination of Bighorn Mountains.

The peak lies slightly to the left of the center in the distance; shows deep cirques cut in the old rounded surface. The rock is granite with vertical cleavage



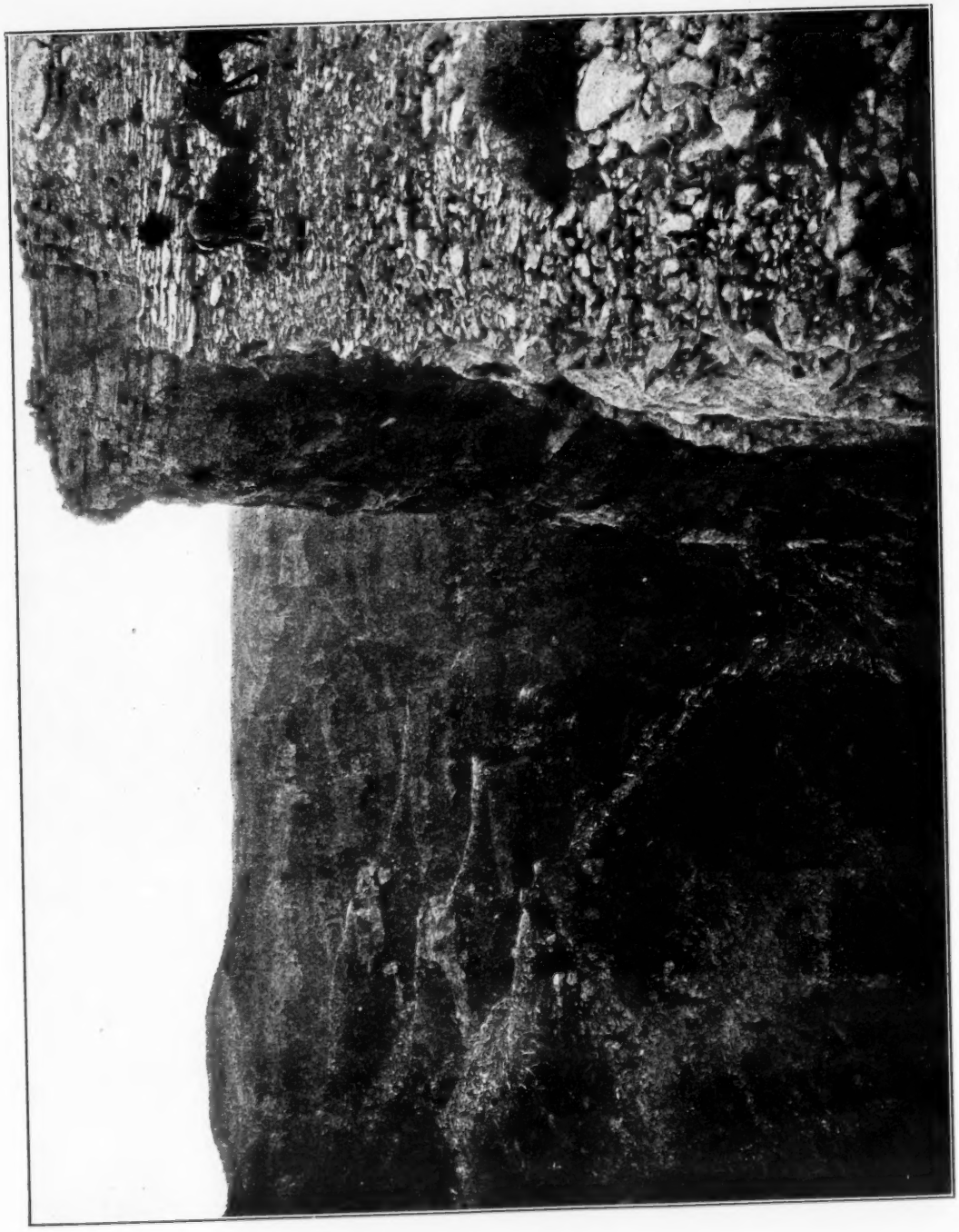
Crest of Bighorn Mountains a Mile North of Cloud Peak; shows Granite Broken by Frost

Looking up the Canyon of Tongue River on the East Side of Bighorn Mountains

Walls of limestone with typical castellated structure; shows flume in which railroad ties are floated from the central mountains to the plains

Canyon of Bighorn River at the North End of the Bighorn Mountains in Montana

Walls of Carboniferous limestone about 1,000 feet high



Canyon of North Fork of Powder River in Southern Portion of Bighorn Mountains
Walls of limestone and sandstone about 1,000 feet high

PICTURESQUE PARAMARIBO

The City Which was Exchanged for New York

By Harriet Chalmers Adams

PARAMARIBO, the quaint capital of Surinam, the city which was exchanged for New York! After a Dutch, a French, and an English occupancy, Surinam (which we English-speaking people call "Dutch Guiana") came again into the possession of the Netherlands through the Treaty of Breda (1667), in which England received title to New Amsterdam, the present site of Manhattan.

The traveler approaches Surinam from the sea. We had left behind the hilly coast of French Guiana, and the morning after sailing from Cayenne entered a wide, muddy channel bordered by marshy lowlands. This was the River Surinam, the great highway of the country.

Our first impression of this transported Holland was of a land with a unique individuality. Ascending the river, we looked in vain on the forest-lined shores for the crude thatched cabins typical of the wilderness in other South America countries. Instead we saw, in well-defined clearings, pretentious farm-houses with gable roofs and dormer windows.

After fourteen miles of river travel came the news, "Paramaribo is in sight!" and we rushed to the bow to see, on the right bank, a collection of these peaked-roofed, many-windowed houses, streets lined with fine old trees, and government buildings facing a grassy common of irregular shape.

Upon landing we were even more impressed with the quaint architecture and with the people who thronged the streets. Paramaribo may well be termed "the city where many types meet."

There are staid merchants from the mother country and gay officers of Queen Wilhelmina's army; there are colonial Dutchmen and their families, who have never been out of Surinam. In great numbers are the blacks, descendants of the slaves.

The costume worn by the negress is unusual, consisting of a short blouse with a deep collar and a long full skirt, which is doubled over a cord at the waist, falling about the hips in an immense puff; this gives the appearance of great weight and awkwardness. A brightly colored kerchief, so tied as to produce a broad effect, drapes the head. In "Taki-Taki," the patois of the blacks, this is termed the "Kottomissi" costume.

"Taki-Taki" is a weird tongue, a mixture of English, Dutch, Spanish, Portuguese, and French; it has probably a touch of an African dialect as well. In it may be traced the imprint of many peoples upon the slaves. It has become "the universal language" of the colony, Dutch being the official tongue.

Three oriental types mingle with the negroes, the Javanese from Hollands' colony in the East Indies, the Chinese, and the Hindus. The latter come from the near-by British colony, where they have served their allotted time as indentured coolies.

The Javanese are small and slight, resembling the Japanese. Both men and women wear scant garments and are bare-legged. Short jackets, often pea-green in shade, adorn the women, and cloths, arranged about the hips, fall to their knees. The costume of the men is like that of the Hindus—white blouses and loin-cloths and huge white turbans.

Gorgeously bedecked are the Hindu women, draped in brightly colored silk scarfs, their plump arms laden with heavy silver bracelets; their ears, noses, fingers, and ankles decorated with gold and silver ornaments. This display repre-

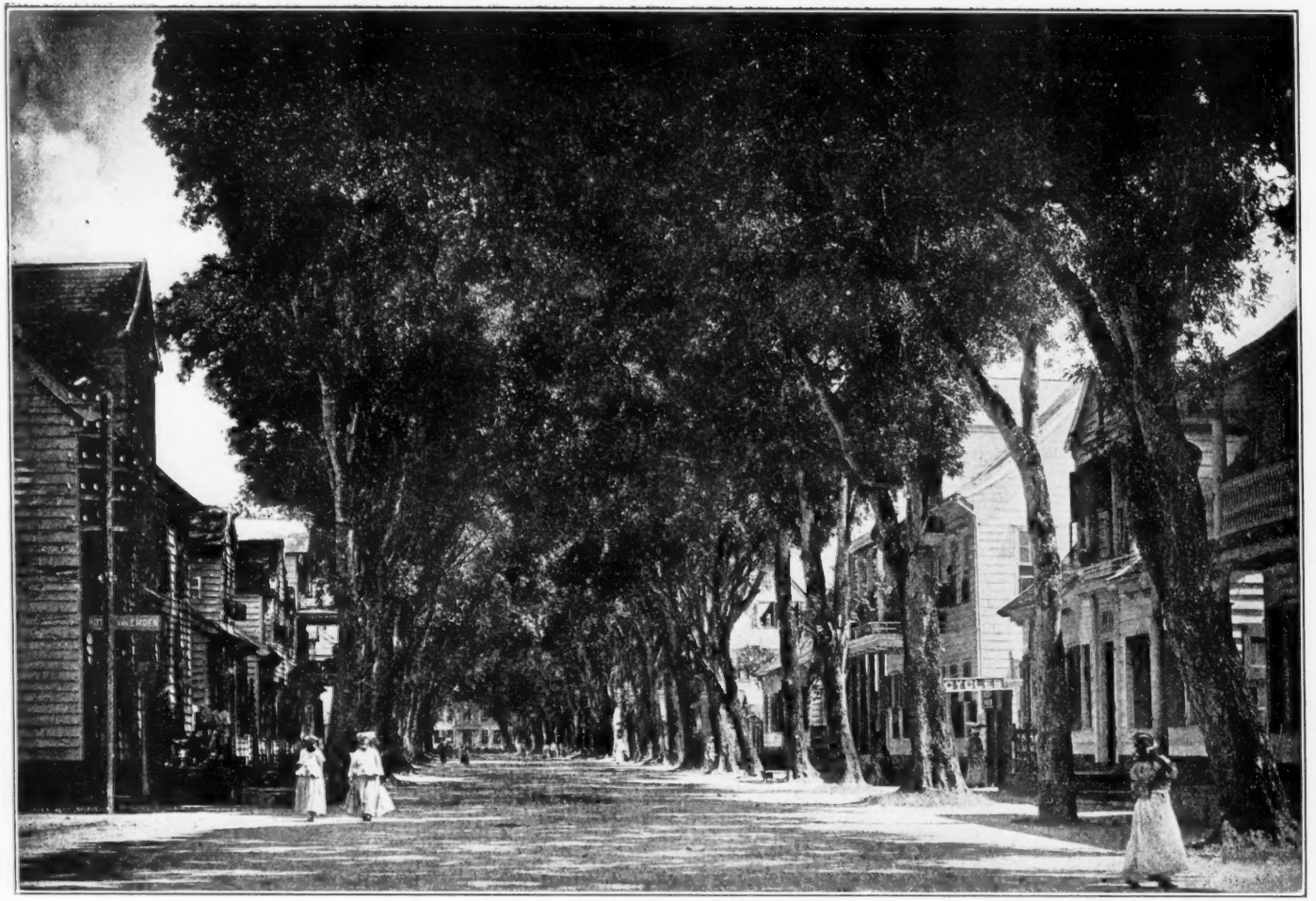


Photo from Mrs Harriet Chalmers Adams

A Street Lined with Mahogany Trees in Paramaribo

The trees are reputed to be worth about $50,000

Photo from Mrs Harriet Chalmers Adams

Market Scene—Paramaribo

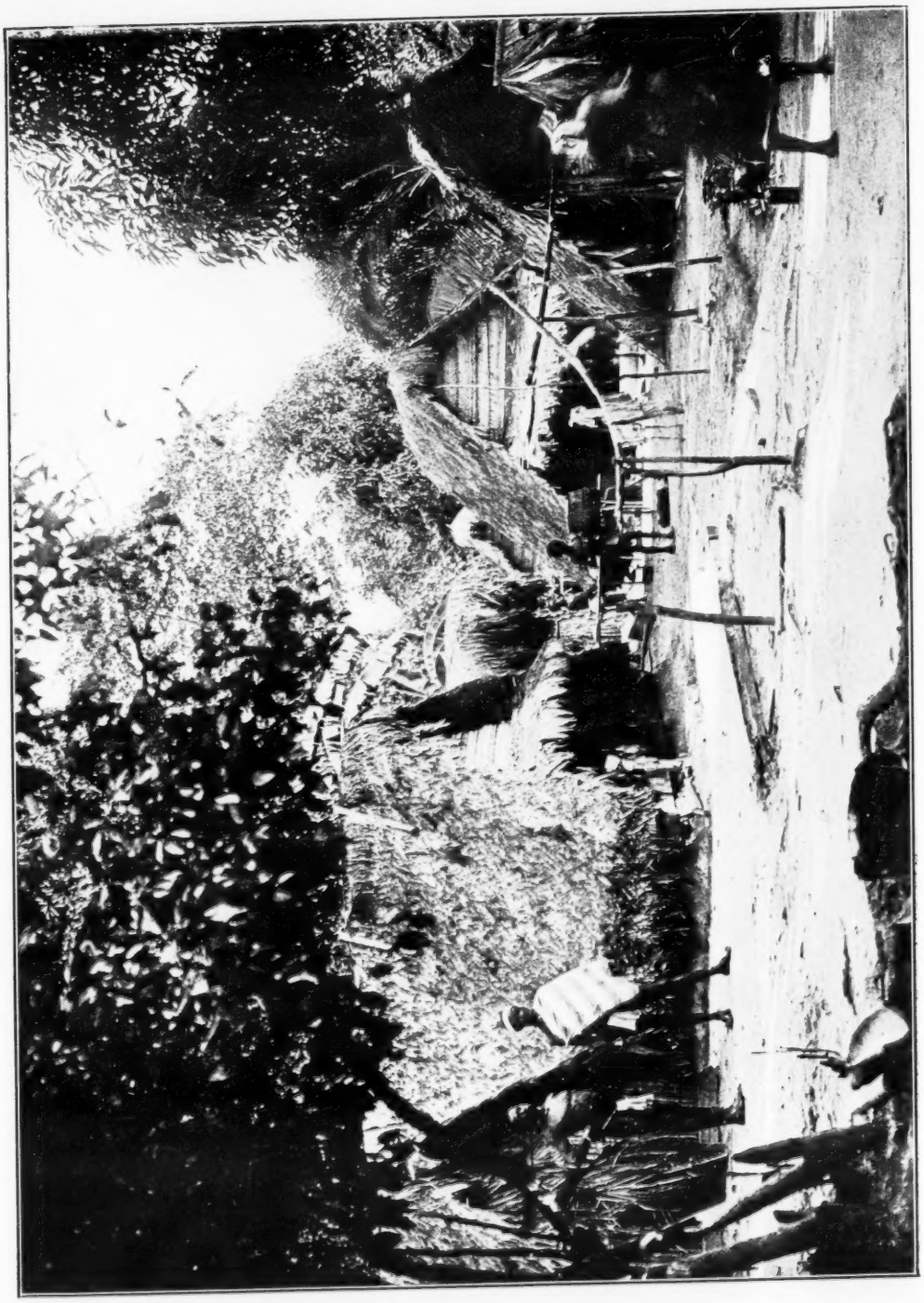


Photo from Mrs Harriet Chalmers Adams

Bush Negroes, Dutch Guianas

Photo from Mrs Harriet Chalmers Adams

Bush Negroes, Wife and Children—Wilds of Surinam

They are the descendents of escaped slaves

Photo from Mrs Harriet Chalmers Adams

A Belle of Surinam

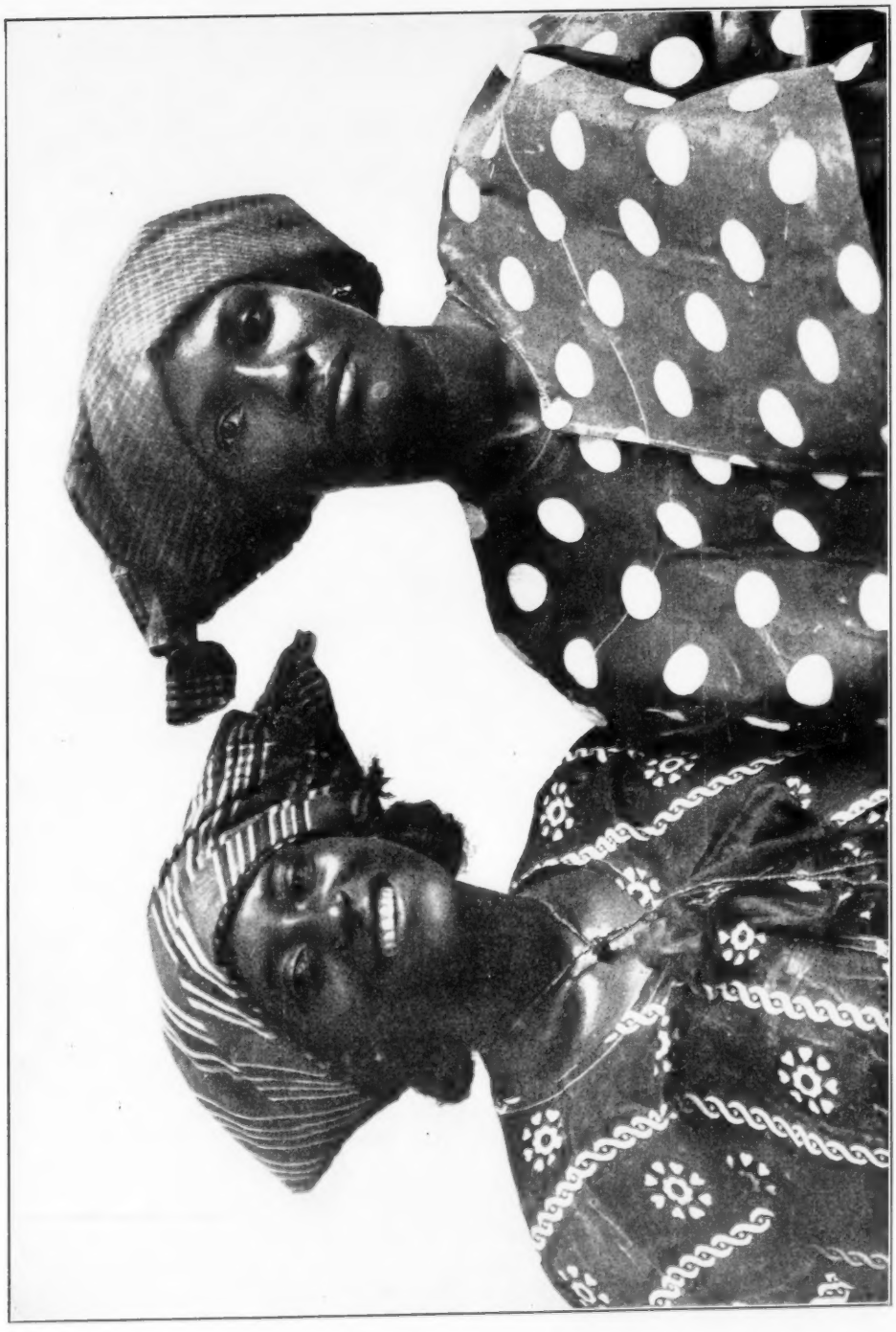


Photo from Mrs Harriet Chalmers Adams

Two Colored Girls of Surinam (Dutch Guiana)

Photo from Mrs Harriet Chalmers Adams

Native Indian Girls in the Bush.

The ones with curly hair show a strain of negro blood

sents the family wealth, and many of the rings and bracelets are of home manufacture.

Now and then, in a crowd of negroes, "Kottomissis," and Orientals, all jabbering "Taki-Taki," we saw a new type of African, unlike any other in the New World. This is the Bosch, or Bush, negro, who inhabits the wilds of Dutch and French Guiana. Occasionally he comes into town to trade.

In the seventeenth century the owners of plantations in Surinam sent their slaves into the forest for a time in order to avoid payment of taxes. Many of the blacks did not return to the estates, escaping to the depths of the forest, where they have ever since maintained themselves as free men. Their habits are not unlike those of the negroes in the wilds of Africa. They are virtually unclothed, have thatched shelters, and worship the ceiba, or cotton tree.

On the streets of Paramaribo we met these men, wearing only an apology for garments, and at times, in the diversified group, saw another forest type, the rightful lord of the country—the native Indian. He had come from his home far up the river to sell baskets, hammocks, and featherwork of his own manufacture.

To study the life of the oriental, one need go only to the coolie villages in the suburbs of the city; but to know the ways of the Bosch negro and the aborigine one must travel by canoe and trail to the "Bush."

Throughout the Guianas the habita-

tions are on the shores of the rivers, and the great forest-covered country beyond is termed the "Bush." In recent years it has become the field for gold-hunters. Surinam's sugar and cacao plantations can be reached by the one railroad of the country, forty miles in length, which in the future may connect the capital with the gold fields. Since the fall in the price of sugar, the country has not been self-supporting and is maintained by Holland through the prosperity of the big sister colony, Java.

Paramaribo is built on a shell reef, and many of its streets are well paved with a mixture of shell and earth. "Heerenstraat" is the city's most attractive avenue—broad and lined with ancient mahogany trees. The story is current that the sum of forty thousand dollars has been offered for these trees, but, being the colony's pride, they are in no grave danger of being sacrificed.

The hotel which we patronized was a clean, airy house, with wide verandas. The rooms were large and finished in natural wood, the table simple but wholesome. Unfortunately, however, this hostelry overlooks the market (pleasantly situated near the city's main sewer), and our room was just above a group of cabins occupied by laundresses, who kept up a steady stream of "Taki-Taki" all day long and late into the night. It seemed to us to be the most "actively conversational language" we had ever heard.

The market-place is a narrow platform shaded by a peaked roof, and the women sit on the floor beside their wares, resembling huge mushrooms in their stiffly starched "Kottomissi" costumes.

A picturesque and an interesting city is Paramaribo, with its glistening white streets, its majestic trees, and its old-fashioned buildings; its blending of many types—European, Asiatic, and creole! Surinam does not seem to us to form a part of South America. We associate it rather with the West Indies, to which it is allied by ties of history, race, and commerce.

AN IMPRESSION OF THE GUIANA WILDERNESS*

By Professor Angelo Heilprin

Of Yale University and Editor of Lippincott's "Gazetteer"

In assigning to me "The Guianas" as a topic in the course of lectures on Latin America, I assume that the Board of Directors has taken for granted a special knowledge on my part of this most interesting section of the earth's surface. In fact, however, the knowledge that I possess, so far as it relates to a personal contact, is derived from a single brief journey made to this region in the spring of last year, undertaken almost wholly for the purpose of satisfying an old-time desire to see the great South American forest, illumined by the writings of Humboldt, Schomburgk, and other great masters, before it was despoiled by man. The conditions of nature in this region as they exist today differ but little from those of a hundred years ago. It is true the force of civilization has invaded the wilderness in spots; has marked out villages here and there; but the aspects of this progress lie mainly toward the ocean front, and the traveler has but to travel a short distance into the interior to find the wild and untrammeled nature which so delighted Waterton.

In the vast area that stretches between

* Abstracted from an address delivered before the National Geographic Society, February 8, 1907.

Photo from Mrs Harriet Chalmers Adams

Indians in a "Dugout," near the Mouth of the Orinoco

the mouths of the Orinoco and the Amazon is a part of that great forest which in magnitude and the exuberance of its vegetal forms finds no equal on the surface of the earth. It is through this wilderness that large and turbulent waters, brown of color and almost unknown except to the geographer, discharge their volume in masses as great as those of the main rivers of Europe—the Rhine, the Danube, the Volga. It is in this region, too, that patches of lofty plateau, seven and eight thousand feet or more in elevation, speak in eloquent language of changes in relief which the slow processes of denudation and land-movement have brought about.

There are three Guianas, namely, Dutch Guiana, French Guiana, and British Guiana. Their characteristics are so fundamentally alike that I will ask you to bear with me if in my general description, as well as in my characterization of impressions, I refer to British Guiana alone.

Almost the only change that one notices today in the interior of British Guiana, compared to what the country was fifty or seventy-five years ago, is that a certain amount of navigation has been imposed upon some of its major streams. Small steam craft, offering as much comfort as one ordinarily wants, and admirably adapted to surveying the landscape, navigate the lower waters for a distance of 60 to 100 miles of the Essequibo, Demerara, Berbice, and Corentyn; and beyond, where rapids break the continuity of the first reaches of smooth water, their service is continued by minor craft, some of them of an almost shiftless character, which lure the traveler or prospector for an almost equal distance farther. In the entire region that is desig-

nated British Guiana there is practically not a single roadway penetrating into the interior. Such roads as exist are those that follow the contour of the ocean, being implanted upon the hard, dry sand which lines the ocean for a long distance, and the few miles following irrigation and drainage canals, which strike out to abandoned cane plantations and to the few sugar mills that continue with a fair amount of success to wage the strife against the competitive industry of beet-sugar.

The first free impression of nature that the traveler obtains in British Guiana is associated with the immediate surroundings of Georgetown, the capital. In the great expanse of meadow land, the savannas of the northern part of the country, which stretch back a distance of from two to twenty and thirty miles, a large stretch of country is below sea-level, and is held in position away from the overflow of the ocean by the construction of sea-walls and sea-dams.

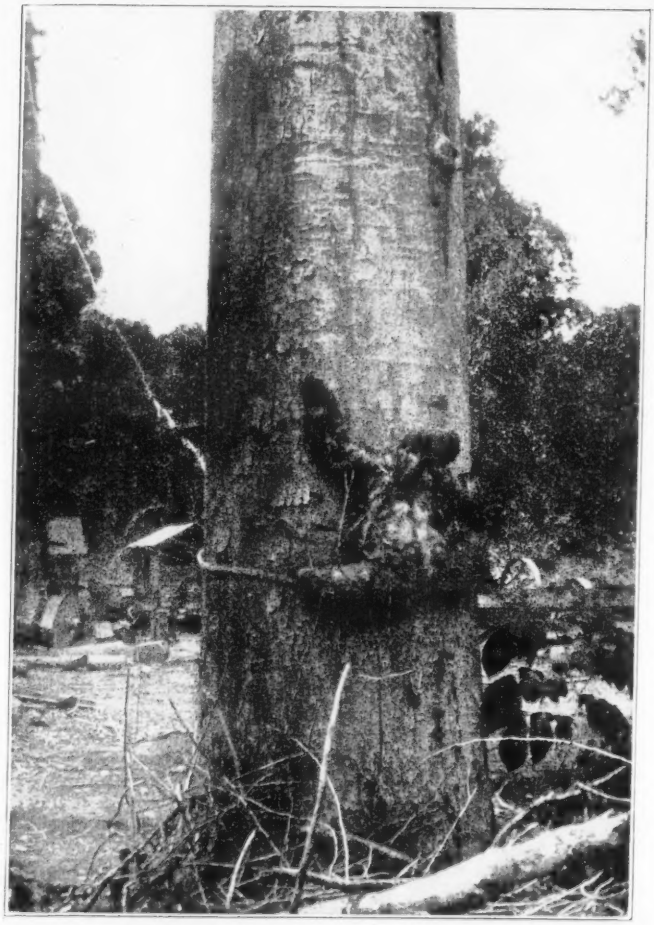


Photo by Angelo Heilprin

A Giant Three-toed Sloth

PROFUSION OF HERONS, ALLIGATORS, ANACONDAS AND ALL KINDS OF LIFE

The profusion of life that is met with—the free life of birds, quadrupeds, and reptiles—is most astonishing. While I had expected naturally to see much of this, yet I was wholly unprepared for the reality, and it was a marvel to note how little heed the animals take of the presence of man. The meadows literally swarmed with the wild fowl of the country: the great white heron, the ibis, egret, and spurwing were out in thousands, caring little as to whether man was near or far. You walk along the short roads that have been constructed along the canals and find almost every bush—practically every tree and every bush that line the road—alive with the hawk and the eagle and other birds of prey, who sit and plume themselves, seemingly regardless of the passing strangers, who may approach them to within five or six feet or less.

The waters immediately about us, although not everywhere, teem with alligators, who likewise appear to bear but little grudge against man. At times

they come out into the roadway, and for a while at least take possession in defiance of man.

I chanced to be an invited guest at the residence of a prominent physician in Buxton, a small hamlet situated a few miles eastward of Georgetown, and had there a rare opportunity of picking up odd and striking facts pertaining to the natural history of the region. On approaching my host's house, which was the type of the regularly constructed "summer-house" of the people of that country, I noted nailed over the veranda the large skin of the water "kamudi," which I was told was the general name in use for the water-boa, or anaconda. The length of the specimen was twenty feet seven inches. I naturally assumed that it was a trophy extending back for a number of years, and that the monster had been killed in the backwoods of the country; but, on inquiry, I was told that the reptile had been killed in close proximity to the house, and that only during the past summer.

On a first afternoon's walk we stumbled upon a specimen of the gray fox, and likewise upon a crab-dog, which the colored people were following and stoning in the manner of the "coon"-hunt in our own southern states. On the following morning a gray fox, its feet closely tied together, was deposited on the steps of our house, awaiting a possible purchaser.

In the course of a side railroad excursion, while waiting for a passing train, I noted in the rear of the post-raised station a single dark object, which for a while baffled analysis, but soon resolved itself into a large-sized manatee. It had come in from the ocean in one of the drainage canals and was cropping the herbage in the puddle that surrounded the depot.

In the course of a later journey up the Essequibo River, close to the banks, we passed a little troop of capybaras, perhaps six or eight in number, which had come out of the forest to take advantage of a protecting sand-spit. A few minutes later a large black jaguar emerged from the forest, and, wholly unmindful of our presence, leisurely walked down the spit in pursuit. We had a splendid opportunity of watching this singularly graceful and lithe animal in a walk of some 150 to 200 yards.

This is the kind of life that still presents itself to the naturalist. I am, perhaps, a little more insistent on this point than seems necessary, but it is for the purpose of correcting the impression that the wild life of the tropics is everywhere becoming a thing of the past. From all that I could learn in Guiana, I should say that there was little change in this life since the day of the publication of Waterton's inimitable "Wanderings of a Naturalist."

THE GREAT PRIMEVAL FOREST

The great primeval forest, which is perhaps represented on a more impressive scale than anywhere else in South America, is the same that was described by the brothers Schomburgk in 1848 and 1850. We traveled up the middle course of the Essequibo River for seventy miles without finding a solitary clearing, not a single break in all the forest, except where tributary streams flowed into our own. On both banks of this chocolate-brown stream, at a distance of seventy miles from its mouth, where the width of the stream is still from one to two miles, or four to five times the normal width of the Mississippi River, the great curtain of the primeval forest hangs virtually untouched by man. If I were asked to state briefly the distinguishing characteristics of this forest, I should find it difficult to frame a reply, or to give to it proper perspective in a comparison with the forest elsewhere. The great South American primeval forest is impressive, is imposing, but at the same time it is forbidding. With the great walls of vegetation rising to a height of 175 and 200 feet, with the crown of the forest carried at this enormous height above the spectator, and with innumerable creepers and trailers binding the whole into an

Photo from Mrs Harriet Chalmers Adams

On the Banks of the Essequibo, British Guiana

almost impenetrable maze, the eye that is on the exterior has difficulty in finding points of rest or repose. But little sunlight penetrates into the recesses of the interior, and what there is of it comes out in scattered flecks of brilliantly reflected light and not as sunlit areas.

In its botanical relations, the forest does not look particularly tropical, if by tropical we mean an aspect of vegetation which is dominated by types that one habitually associates with the lower climes and whose general physiognomy differs from the types of temperate regions. It is true that the eye fails to note the familiar forms of the oak, the maple, beech, birch, or poplar; but the general contour of tropical foliage, especially where it appears lost in mass, is not very different from that of these trees or of trees that in one form or another make up the bulk of the north woods. Except where clumps of palms stand out in particular relief, the trees of the South American forest have, apart from exceeding luxuriance and magnitude of dimensions, so nearly the characteristics in foliage of the trees of our own region that the traveler could easily misinterpret the landscape of which they formed a part. Even where palms are present, they generally lose their crowns in the

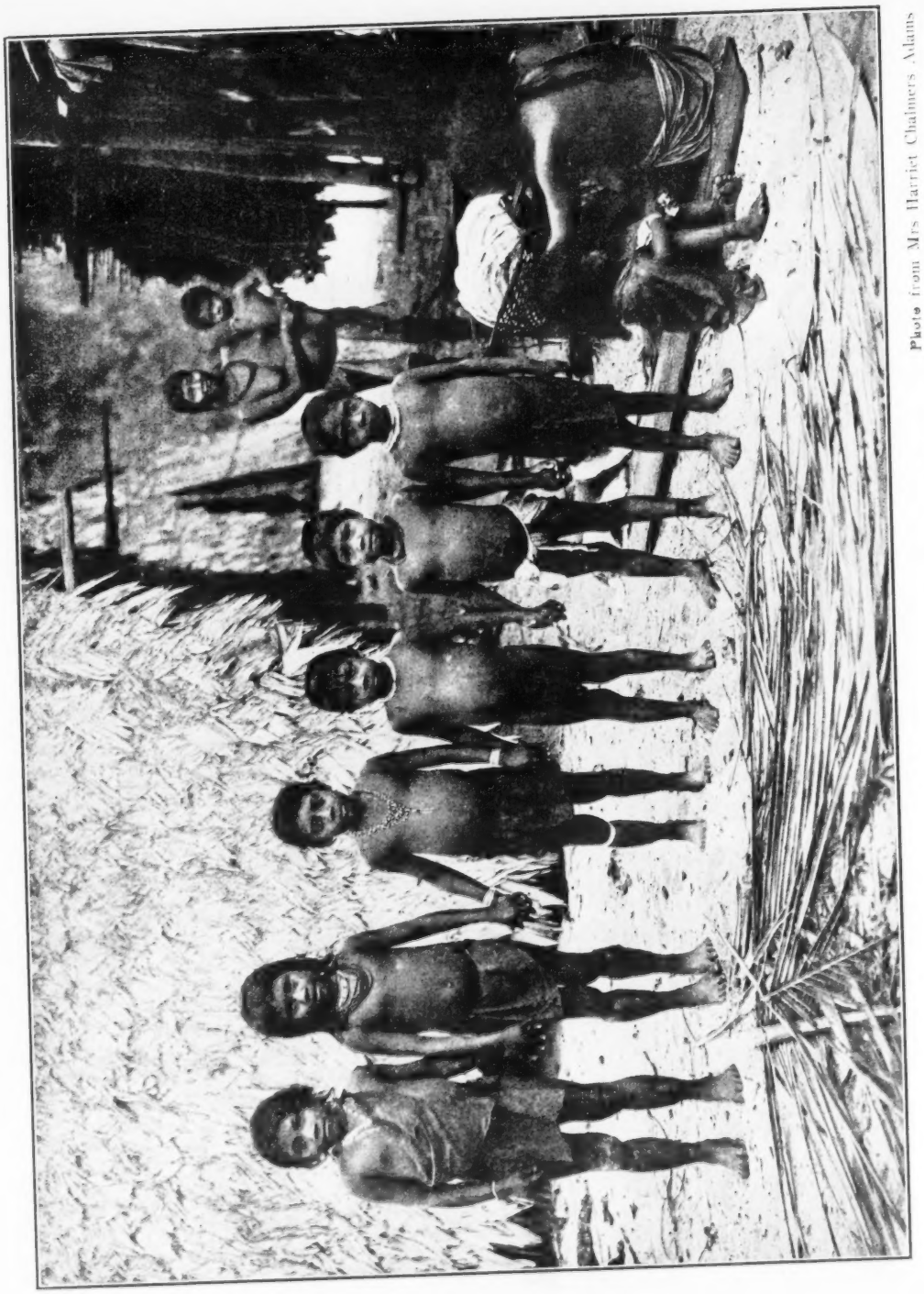


Photo from Mrs Harriet Chalmers Adams

Indian Children in the Wilds of Guiana

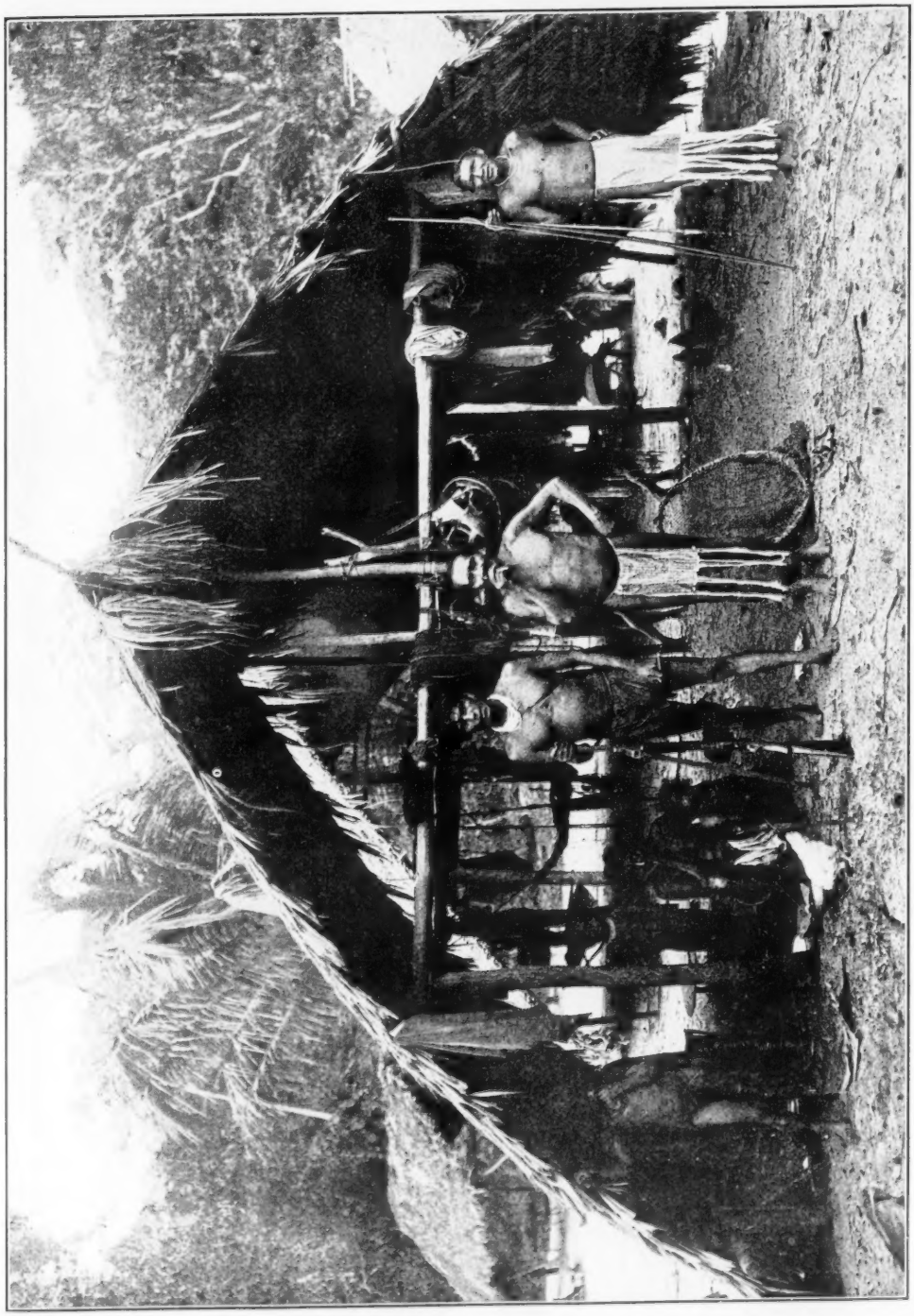


Photo from Mrs Harriet Chalmers Adams

An Indian Family of the Guianas

Photo from Mrs Harriet Chalmers Adams

In the Great South American Forest

wall of vegetation that rises above them and no longer appear as dominating or physiognomic types in the landscape; they are hardly more than sporadic components of the vegetation.

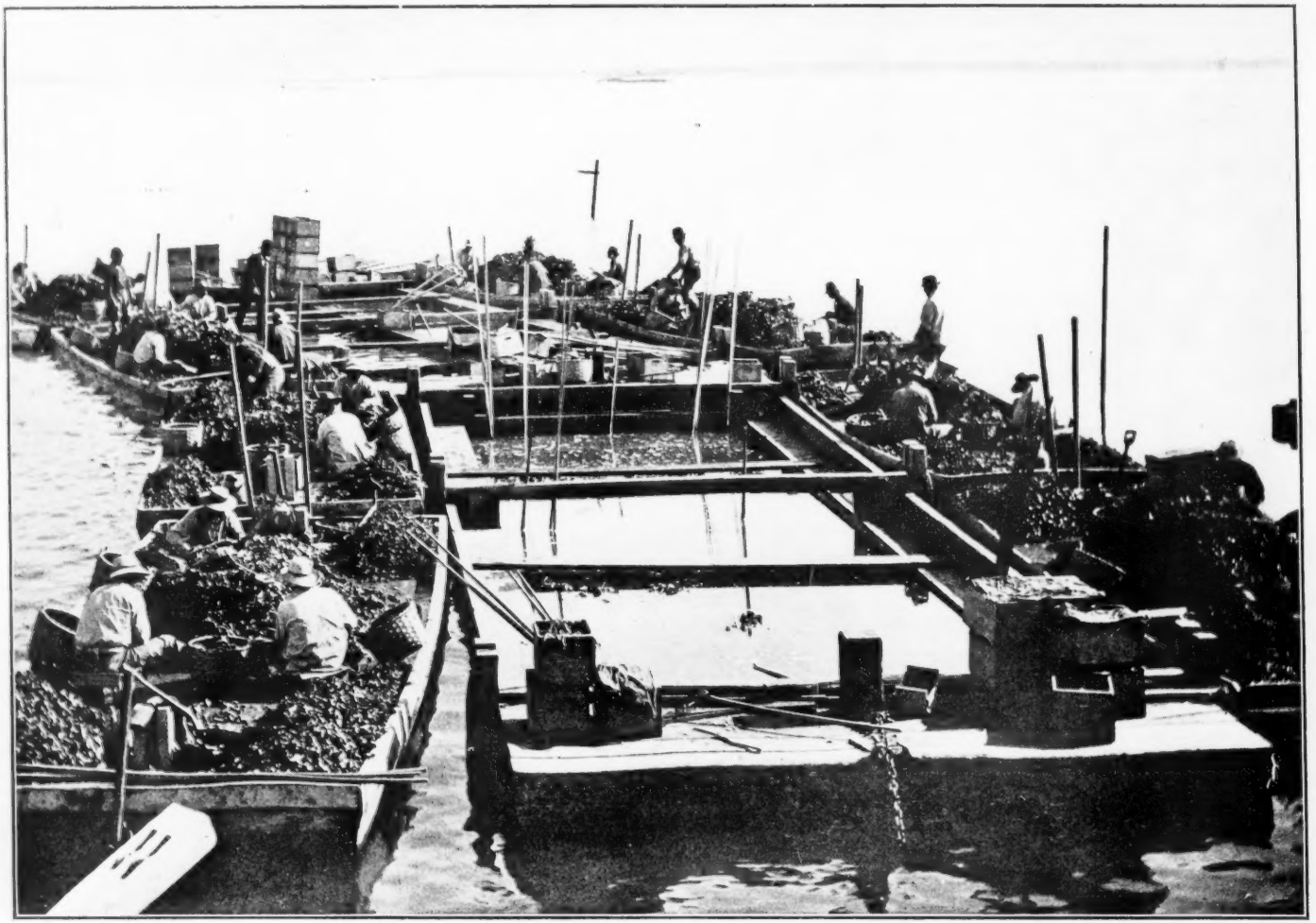
It is only when we penetrate into the interior of this great forest, when we study the individual elements that compose it, that we begin to be impressed with distinctive characteristics. One can truly say that almost every tree of the South American primeval forest is a botanical garden of its own. Rising up in supreme magnificence, the trunk hardly sending out a branch before it has attained a height of 125 or 150 feet, and completely overgrown with creeping and climbing plants, aroids and orchids, it is as wholly different from the trees of the northern woods as it well can be. The tendency to spreading umbrella-like crowns likewise differentiates the forest components of the south, as do also the giant buttressed roots which distinguish so many of the species.

Alfred Russell Wallace, who has enjoyed unusual advantages for the study of the general characteristics of tropical vegetation, has emphasized as one of the marked features of the tropical forest the absence of flowers. He says, indeed, that one may travel for weeks at a time along the streams of the Amazon region without once realizing those aspects of floral development which, whether by profusion of growth or by size and color, impress the landscape of temperate regions. This picture does not seem to apply to the forest of the river banks of the Guianas, and its inaccuracy has been pointed out by that acute student of nature Mr M. Turn. The streamers of purple, red, and white which hang down over the forest curtain easily recall in profusion and wealth of color the flowers of the north—the field daisy, clover, and buttercup. Indeed, it would be difficult to recall in forests of the north, even as rare instances, that display of flowers which so frequently repeats itself here.

The extraordinary passifloras, the cassias, the rhexias, and innumerable orchids are a glory unto themselves. It is only on or close to the banks of the rivers that the forest in any way approaches impenetrability. Farther inward, where the more majestic portion of the forest is reached, there is comparatively little undergrowth, and the giant foresters stand up unbroken, like the supporting pillars the interior of a church..

The animal life of the forest surprised me by its numbers. It was not the silent wilderness, the nature that was hushed to sound, that the writings of some naturalists had led me to believe that it was. From the early hours of morning until sunfall, the forest rings with the cries of the Toucan and parrot, while the metallic tones of the chatterers and buzz-saw beetle swing out in majestic cadence a parting of the ways. At night-time this side of the forest is silent; but other strange sounds—the fitful roar of the howling monkey, the croak of the Surinam toad—give ample evidence that the land is still of the living. It was this way, at least, that I found the forest in April. There were but few insect pests to annoy one, and that assumedly omnipresent torment of the southern wilds, the mosquito, was virtually entirely absent.

This brief picture is, without doubt, not the true picture of the entire Guiana wilderness, but it is an impression which a few weeks' journey of wholesome pleasure has brought to me.

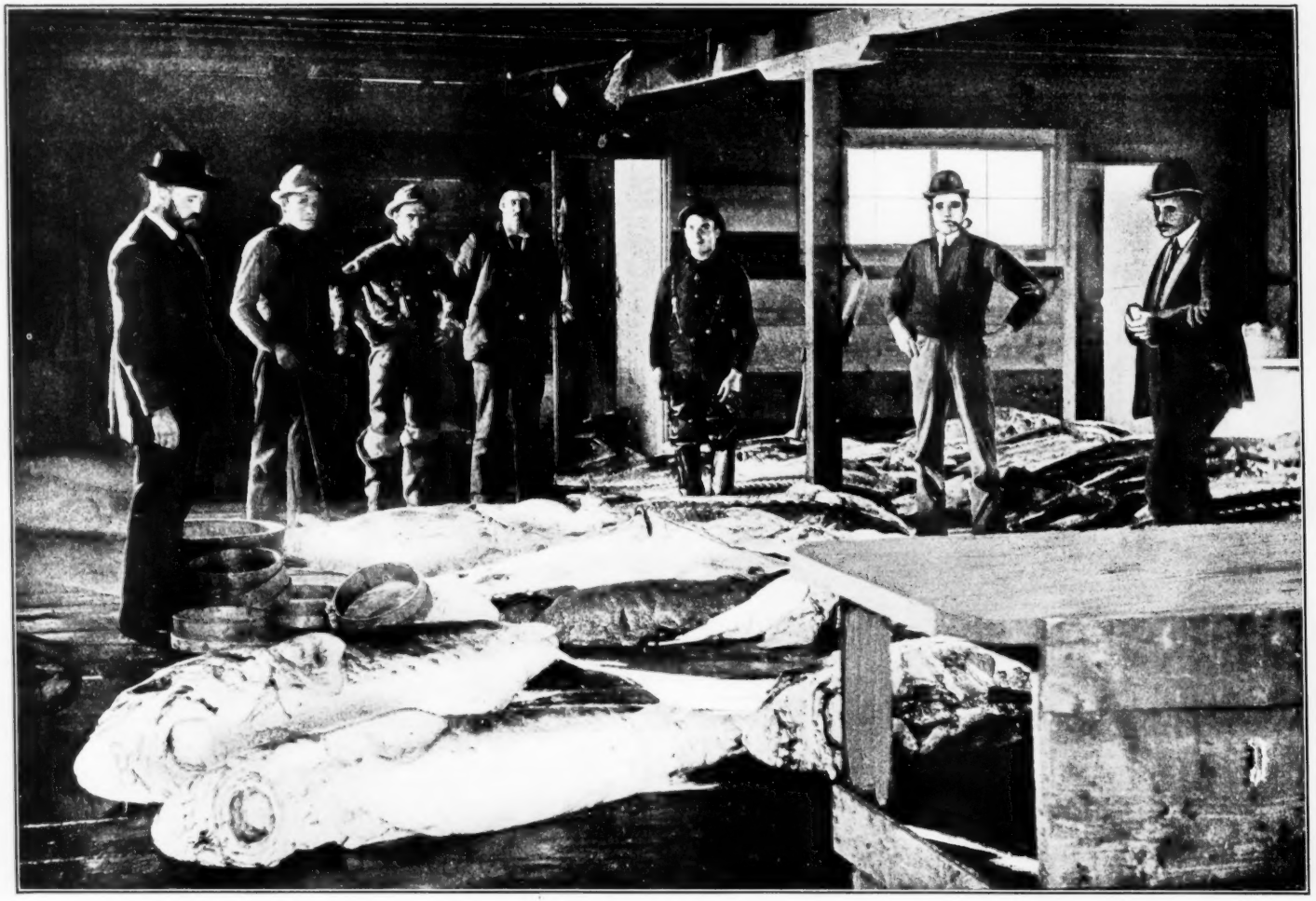


Part of the Oyster Crop in San Francisco Bay Photo from U. S. Bureau of Fisheries

The eastern oyster was transplanted some years ago and now yields an annual output worth $600,000 (see page 394)

Beach on Western Side of San Francisco Bay — Photo from U. S. Bureau of Fisheries

Composed entirely of native oysters which, at this place, extend in an unbroken line for 12 miles. These oysters are seldom eaten
(see page 394)



Preparing Caviar on the Columbia River

Photo from U. S. Bureau of Fisheries

Notice the exposed roe of the sturgeon in the center of the picture

OUR FISH IMMIGRANTS

By Hugh M. Smith

Deputy U. S. Commissioner of Fisheries

ONE of the most important, extensive, and interesting lines of utilitarian work conducted by the federal government is the transplanting of native aquatic animals into waters in which they are not indigenous, and the introduction of fishes of foreign countries into the United States. Most people are familiar with the economically important results of acclimatizing foreign species or varieties of mammals and birds in our country, and every one can recall some of the many valuable vegetables, fruits, and other plant products that are immigrants; but comparatively few people are aware of the systematic and varied measures that have been taken by the government for increasing and enriching the supply of food and game fishes of every section of the country, and still fewer realize the extent to which the commercial fisherman, the sportsman, the youthful angler, the farmer, and the public in general are indebted to the National Bureau of Fisheries and the state fish commissions for providing many kinds of useful creatures that did not originally inhabit given waters.

OBJECTS OF ACCLIMATIZATION

When we contemplate our wonderful aquatic resources—unsurpassed as a whole for variety, abundance, and excellence—the question naturally arises as to the necessity for planting non-indigenous species in any of our waters. The occasion for such efforts comes from a number of conditions which have been duly considered by the authorities; among these are:

(1) The depletion of the indigenous fishes of given waters and the inability to secure the reëstablishment of those species, either by restrictive measures or by artificial propagation, owing to changed or changing physical or biological conditions.

(2) The possibility of enriching the fish fauna of a given water by introducing more useful species than already exist therein or by affording a greater variety of fishes for food and sport.

(3) The existence of physical or other conditions more inimical or unfavorable to the native fishes than to other fishes that might be introduced.

(4) The possibility of relieving the drain on native species by providing new objects for the pursuit of the angler and the commercial fisherman.

(5) The desirability of reducing the abundance or securing the extermination of noxious fishes and other water animals by planting fishes which will prey thereon.

Features of aquatic acclimatization which may be noted especially are the interchange of products between the eastern and western parts of the country, the introduction of eastern fishes into new waters of the east, and the importation into the United States of fishes from foreign countries. This work has affected not only the lake and pond fishes, but also the migratory river fishes of both seaboards and some strictly salt-water forms; and since, for practical purposes, the term "fish" has generally been construed as meaning every kind of animal taken from the water for profit or pleasure, the operations have involved many creatures that the biologist would not class as fish.

SOME INSTANCES OF UNWISE INTRODUCTIONS

The seemingly benign and beneficent work of transplanting water animals is not wholly free from possibly harmful results, analogous to those that have attended the transplanting of land animals, of which the rabbit in Australia, the mongoose in Jamaica, and the English sparrow and Norway rat in America are well-known examples. Even when such transplanting is done advisedly and with circumspection, there is a possibility of untoward results that will offset any benefits that may accrue. Injury may arise from a general disturbance of the "balance of nature" by the introduction of new factors into given waters, or from the supplanting of one kind of animal by another less desirable. The ignorance or indiscretion of private persons who undertake to introduce new creatures into waters in which they are interested may produce most disastrous effects, while in a few instances carelessness or a mere accident has had a far-reaching effect. Great care has been exercised by the Federal Fishery Bureau in making plants of non-indigenous fishes, and injurious results chargeable to it have been extremely rare; but eternal vigilance is necessary, and many applicants for fish become disgruntled because they are not permitted to have their own way. Fine trout streams may be quickly ruined through the planting therein of bass, or lakes stocked with some defenseless valuable food-fish may be depleted by the thoughtless planting of some comparatively unimportant rapacious species.

Some of the states have been quick to recognize the necessity for restricting the planting of non-native fishes, and have enacted laws prohibiting the introduction of any fish not approved by the state authorities. One of the most persistent demands on the Bureau of Fisheries is for black bass to stock western waters that already contain an abundance of trout or salmon. Such practice is little short of criminal, and in all such cases where there is reason to fear that valuable trout waters may be ruined the Bureau takes the precaution to defer to the judgment of the state fishery officers.

One of the most unfortunate instances of the destruction of one species by another is that of the grayling, a superb food and game fish of which only three colonies had survived some cosmic cataclysm and had become established in regions as isolated as Alaska, Montana, and Michigan. In the last-named state trout were recklessly planted in some of the few streams inhabited by the grayling, with the result that the grayling has been completely exterminated therein. It is only in Tennyson's "Brook" that

> here and there a lusty trout
> And here and there a grayling

live in harmony together.

With the transplanting of eastern oysters on the western seaboard, there has been introduced one of the small boring mollusks or drills which is very injurious to oysters on the Atlantic coast and is maintaining its reputation in California. It has become very abundant, and several years ago was reported to be destroying annually oysters to the value of $30,000.

Another unfortunate case of accidental or unintentional acclimatization is that of the alewife in Lake Ontario. By means of canals, the alewife found its way from the Delaware or Hudson River into Lake Ontario, and there soon became excessively abundant; but lack of food or the changed habitat resulted in a stunted race of no economic value, and furthermore this fish is subject to a periodical epidemic which kills millions each season; these pile up on the shores or pollute the water, and prove such a menace to health that the local authorities are often put to considerable expense in removing them. It is possible, however, that by serving as food for other fish the alewives in Lake Ontario are saved from the stigma of being unmitigated nuisances.

Another untoward aspect of the acclimatizing of native fishes is the annoyance or confusion which may come to

future students of geographical distribution and variation. A phase of this work is seen in the long-continued and wholesale planting of shad from the Potomac, Susquehanna, and Delaware rivers in practically every other stream on the Atlantic coast, with the result that whatever local varieties or races of shad may once have existed are now no longer recognizable. Some years ago I undertook to verify the oft-repeated contention of old fishermen, that shad from different parts of the coast exhibit peculiarities of form and color; and, as a matter of fact, this was to be expected, from the views now held regarding the migration of the species—the schools that enter a given region, such as Chesapeake Bay or the Gulf of Maine, not being made up of individuals hatched in numerous or widely separated hydrographic basins, but constituting a definite contingent whose immediate and remote ancestors had frequented the same waters. In this inquiry many thousands of specimens from the Saint Johns to the Kennebec were critically examined, but with only negative results, so far as the existence of local races was concerned, and the conclusion was reached that the promiscuous artificial mixing of shad in the different rivers had led to the final obliteration of whatever differences had originally existed.

Fortunately the artificial extension of the range of our interior and coastwise fishes is not so serious a matter now as it would have been earlier, for the systematic examination of our lakes and streams under federal and state auspices has gone so far that the natural geographical range of nearly all our fishes has been accurately determined.

EASTERN FISH IN NEW EASTERN WATERS

In all the waters of the eastern half of the country the range of all the important native food and game fishes has been extended artificially. Very extensive work has been done with the black basses, the crappies, the rock bass, the brook trout, the land-locked salmon, the lake trout, and the more desirable catfishes, while a number of very excellent fishes with restricted original distribution have been judiciously scattered and thus brought to the notice of thousands of people who would otherwise never have known them.

The debt that sportsmen owe to the fishery service of the United States and the several states for their acclimatization work is heavy and increasing yearly, and the obligation is shared indirectly, but not the less actually, by hotel-keepers, boatmen, merchants, land-owners, and others. There could be cited numerous concrete examples of the varied benefits that have come to communities through the stocking of local waters with non-indigenous species. In some cases the improvement in the fishing has so increased the influx of people that land about the waters has increased several hundred per cent in value in a few years.

SALMON IN HUDSON AND DELAWARE RIVERS

A controversy was waged for many years over the question whether the Hudson was originally a salmon stream. The chief basis for the belief that the Atlantic salmon frequented that river in former days was the mention of salmon in several early Dutch documents and in various entries in the log of the *Halfmoon* during Henry Hudson's memorable visit to the river in 1609. No salmon were actually caught by Hudson's crew, and there is every reason to believe that the fish they saw and the fish referred to in the records of New Holland were some other species. Certain it is that there is no evidence of the existence of salmon in the Hudson, except possibly as mere stragglers, at any time during the eighteenth century or in the nineteenth century, until about 1890, when the national government, coöperating with the State of New York, attempted to establish the salmon in this noble river—a feat that would have meant a great deal to anglers, net fishermen, and the general public.

It is a matter of no little interest that as early as 1771 the colony of New York

had under consideration the question of transplanting salmon from Lake Ontario or from neighboring rivers to the Hudson, and in that year, at the instance of the corporation of Albany, a law was enacted prohibiting for a term of years the taking of such introduced fish. This project, however, does not appear to have been followed up, and it remained for the present generation to give it a trial. The states bordering on the Delaware were also solicitous for the introduction of salmon into that stream, which had never contained salmon, and the test was made therein about the same time.

Of the many salmon streams that New England once had, the only one that has survived is the Penobscot, and this has been maintained solely by artificial means, for natural spawning has for some years practically been suspended. It was at the well-known salmon hatchery located on Craig Brook, a tributary of the Penobscot, that the young fish for stocking the Hudson and Delaware were hatched and reared. Rather liberal plants were made for several years, beginning in 1890, and in the fifth year after the first deposits mature fish began to be caught in the nets of the shad fishermen. It is a matter of record that over 300 salmon weighing 10 to 38 pounds were caught illegally in the Hudson in 1895, and fully 300 were taken in the Delaware in the same year and sold. This gratifying outcome was widely heralded as establishing the feasibility of inducing a permanent supply in these rivers; but, unfortunately, when the planting of young fish was discontinued the run of adult fish in due time declined, and today those waters are as free from salmon as they ever were. These efforts, however, were not altogether useless, since they showed (1) that the young fish ran to sea, remained in the vicinity of the rivers until mature, and then were impelled by the spawning instinct to return to the same rivers, and (2) that the streams proved unfavorable for natural reproduction, for there is little or no evidence that effective spawning took place.

Whether the making of large plants for a long series of years would eventually establish the salmon in these two rivers and in others formerly inhabited by the fish is perhaps an open question, but to my mind is very doubtful. The physical conditions in most of our northern streams are each year becoming more unsuitable for such species because of obstructions, pollutions, clearing of forests at their headwaters, etc.; and if it is possible to establish any kinds of salmon therein the greatest chance for success lies with some of the less fastidious western species.

STOCKING THE POTOMAC WITH NEW FISHES

As an example of what may be done for a large stream in the way of beneficent acclimatization, the case of the Potomac River may be cited. The commercial fisherman, the professional fly-caster, and the casual angler all have cause to render profound thanks for what has here been accomplished in their interest.

The most valuable non-indigenous fishes now inhabiting the Potomac are the small-mouth and large-mouth black basses. Ichthyologists and fish culturists are well aware that these most excellent food and game species are not native to this river, but their introduction occurred so long ago that the general public has lost sight of the interesting facts connected therewith. It was in 1854, shortly after the completion of the Baltimore and Ohio Railroad, that a lot of small-mouth black bass from the Ohio River were brought east in the water tank of a locomotive engine and liberated in the basin of the Chesapeake and Ohio Canal at Cumberland. Having free access to the Potomac, the fish soon found their way to various parts of the river, and inside of ten years literally swarmed in all the tributaries from Mount Vernon to the headwaters. At the present time the species affords much sport from Washington to Harpers Ferry and beyond, but is not common below the capital. The

introduction of the large-mouth black bass into the Potomac basin was accomplished by the Bureau of Fisheries in 1889, the first plants being made in the Shenandoah and later in the vicinity of Washington. By 1896 the fish had become remarkably abundant, and now it is taken in large numbers by net fishermen and anglers in all the lower fresh-water reaches of the river.

The strawberry bass and the crappy were established in the Potomac by the Bureau of Fisheries in 1894, and both are now common in a long stretch of the stream from Alexandria upward. They are excellent food and game fishes, and many are caught by anglers and many are sold in the Washington markets. Other members of the bass family that have been colonized in the Potomac are the rock bass, the warmouth, and the blue-gill.

As a result of plants of fry between Washington and the Great Falls, the wall-eyed pike or pike perch, the largest and most valuable member of the perch family, has been acclimatized and for five or six years has been attracting attention. It is not yet very numerous, but apparently is becoming more so each season and in time should prove a valuable addition to the supply of fishes caught for market and for sport.

Not the least important of the additions to the Potomac fauna are two catfishes from the Mississippi basin. One of them, the spotted or blue cat, is probably the best of the tribe, inhabitating cold, running water, having dainty feeding habits, possessed of game qualities scarcely inferior to those of the bass, and being excellent food. Small plants of adults and yearlings were made at Quantico, Virginia, and Woodmont and Hagerstown, Maryland, in 1889, 1891, and 1892; and since 1899 the fish have been taken in increasing numbers each year, especially between Washington and Little Falls, many of them weighing 10 to 20 pounds. Recently there have appeared in the river considerable numbers of another species, the great fork-tailed cat, of the introduction of which there was no record; so it is evident that the young were mixed with the spotted cats and were overlooked when the plants were made. This fish reaches a weight of more than 100 pounds in its native waters, and examples taken from the Potomac by line fishermen have weighed upward of 30 pounds.

CONTRIBUTIONS OF THE EAST TO THE WEST

Probably the most noteworthy results attending the introduction of aquatic animals into new regions have been seen in the Pacific states, and represent contributions from the eastern seaboard. Among the eastern fresh-water fishes that have been firmly established and more or less widely colonized in the Rocky Mountains or in regions beyond the mountains are the large-mouth black bass, the crappy, the yellow perch, the pike, several catfishes, various sun-fishes, the land-locked salmon, and the brook trout. The sportsmen of all the western states are now afforded excellent black-bass and brook-trout fishing. Migratory eastern river fishes that have been permanently introduced into the Pacific streams are the striped bass and the shad, and the economic results therefrom are without parallel in the entire history of migratory fishes. Chief among the marine invertebrates of the Atlantic coast that are now found on the west coast are the oyster and the soft-shell clam.

A few years ago a fishery official of an eastern state made the prediction that the brook trout is doomed and will be unknown, as a wild species, a few generations hence. This gloomy prognostication is perhaps justified if restricted to certain streams of New England and New York, where pollution, obstructions, and deforestation have already destroyed many fine waters and are ruining others; but in the eastern lakes the brook trout is more than holding its own, while the west is prepared to afford unsurpassed trout fishing for the entire country. The attention of anglers should be directed to Colorado, which has known the brook trout for only a few years, but is now

more thoroughly stocked than any other state. So successful has been the work of acclimatization in Colorado that the government now draws on that state for most of its supply of brook-trout eggs, which are obtained chiefly from wild fish in mountain streams and lakes; and it is in accord with the eternal fitness of things that the progeny of Colorado brook trout should be used for replenishing the very eastern waters from which the original stock was taken for introduction into Colorado.

It is generally conceded that the Yellowstone National Park affords some of the very best trout fishing to be had anywhere in the world. The thousands of anglers who have dropped their lines in the limpid waters of that wonderland and the thousands and millions who are yet to enjoy the delights of fly-fishing and trolling amid those most inspiring scenes have been and will be indebted to the paternal solicitude of the federal government, which has not only stocked lakes and streams of the park which had from time immemorial been entirely destitute of fish life, but each season, in a quiet but effective way, takes steps to maintain and increase the supply of trouts. Furthermore, a commendable policy has been adopted and adhered to by which different kinds of trouts are kept in separate waters, so that the park gives opportunity for the most varied and at the same time the most specialized trout fishing. Thus, in one river basin the black-spotted trout exists to the exclusion of other species, in another the rainbow, in another the brook, in another the lake, and in others several European trouts.

SHAD ON PACIFIC COAST

The colonizing of the shad on the Pacific coast was one of the greatest achievements in fish acclimatization. Aside from the important economic results, the experiment was noteworthy because of certain changes that have occurred in the habits of the species, and because the feat of transporting shad fry across the continent at that early day was justly regarded as remarkable, and had a marked influence on the development of fish transportation, which has now attained such perfection. With the experiment were associated two of the pioneer fish culturists of America, whose names and fame are known the world over—Seth Green and Livingston Stone.

It was in 1871 that the California Fish Commission made arrangements with Seth Green to take to California a lot of young shad from the Hudson River. He started with 12,000 newly hatched fish in four 8-gallon milk cans, and by indefatigable efforts succeeded in carrying his delicate wards to the Sacramento River and planting 10,000 of them at a point 275 miles above Sacramento. In 1873 Mr Livingston Stone, of the U. S. Fish Commission, carried to the Sacramento a second lot of shad, 35,000 in number, also from the Hudson River. In 1876, 1877, 1878, and 1880 further plants, aggregating 574,000, were made in the same river. In 1885 and 1886 deposits aggregating 910,000 were made in the Columbia River. No shad fry were introduced into the Sacramento after 1880 or into the Columbia after 1886.

That the shad found the waters of the Pacific states entirely congenial was quickly demonstrated. In April, 1873, a shad 1 year 9 months and 20 days old and weighing 3 pounds was caught in the harbor of San Francisco, and the lucky fisherman was paid a reward of $50 offered by the California commissioners for the first shad. In a short time many more were taken in the vicinity of San Francisco; by 1879 they had become numerous; by 1883 the supply in some places was reported as almost unlimited, and a few years later the shad were regarded as one of the most abundant food fishes of California, and the price to fishermen and consumers was less than in any other state.

Shad were first taken in the Columbia in 1876 or 1877, so it is evident that an offshoot from the California colony soon migrated northward and had already established itself when the new emigrants

arrived from the east, 8 or 9 years later. By 1881 the fish seems to have become distributed along the coast of Washington, and in 1882 reached Puget Sound. It was 9 years later, however, when the first pioneer was recorded from Fraser River, and the same year there was a report of shad in Stikine River, southeast Alaska. In 1904 a fine roe shad caught at Kasilof, on Cook Inlet, was the first known arrival in that remote region. To the southward the fish is found as far as Los Angeles County, and the present range of the species thus extends along about 4,000 miles of coast. It is not improbable that the migrations of the shad will extend still farther. Twenty years ago, when the fish was found along only 2,000 miles of coast—from the Golden Gate to Puget Sound—the national fish commissioner at that time suggested that the species would follow the track of the Asiatic current and eventually reach the coast of Asia and establish itself in some of the great rivers. This prognostication has not yet been realized.

The two great centers of the shad's abundance are the Sacramento basin and the lower Columbia River, and it has been asserted that in either of these waters more shad could be taken than in any other water-course in the country. The catch affords an inadequate criterion of the shad's abundance, for fishermen and dealers report that it would be easily possible, should the demand warrant it, to treble or quadruple the present yield, as most of the fish are now taken incidentally in apparatus set primarily for other species.

Viewed from the purely business standpoint, the transplanting of shad to the Pacific coast has been a remarkably good investment. As near as I can ascertain, the total cost of the experiment was under $4,000, and the results in California, Oregon, and Washington have been approximately as follows:

Annual catch at present time...	1,500,000 lbs.
Aggregate catch to end of 1906..	13,250,000 lbs.
First value of aggregate catch.....	$302,000

Were it not that the shad has to compete with a great variety and abundance of other excellent fish, for which there is a strong predilection born of habit and sentiment, this species would be in the front rank of west coast fishes in the popular estimation. Notwithstanding its excellence, abundance, and cheapness, it is not very popular in the west, but there are indications that it is becoming more generally appreciated.

It is not an altogether unreasonable suggestion that a few generations hence eastern people will be compelled to obtain their shad from Pacific waters, for the very destructive fishing methods now pursued in the eastern rivers are having a most disastrous effect on the perpetuation of the species, and in some streams the death knell of the shad has already been sounded. Rivers on which the general government has been conducting shad-hatching operations for 30 years have recently been deprived of practically their entire run of spawning fish, and the hatcheries have been rendered useless. The cultivation of shad on a small scale was begun in the Columbia River in 1906.

STRIPED BASS ON PACIFIC COAST

The history of the introduction of the striped bass on the western seaboard is quite similar to that of the shad, and the results have been equally striking. In 1879 the Federal Fishery Bureau planted in an arm of San Francisco Bay about 135 striped bass, mostly 1½ to 3 inches long, from the Navesink River, in New Jersey. A second plant of 300 small fish from the Shrewsbury River, New Jersey, was made near the same place in 1882. There were no other transhipments of this species; and in contemplating the outcome of this experiment after the expiration of a quarter of a century, well may we exclaim, "How great a fishery a little plant hath made!"

The striped bass found the waters of San Francisco Bay and its tributaries as congenial as did the shad, and has shown an almost uninterrupted increase in abun-

dance to the present time. A number of years ago the California striped-bass catch exceeded that of any other state, while now it surpasses that of any group of states along the eastern seaboard.

From the San Francisco region the species has gradually spread up and down the coast, and its range may eventually equal that of the shad. Up to 1896 the fish had not been reported outside of California, but several years ago it began to run in some of the coast rivers of Oregon, and in the fall of 1906 half a dozen fine specimens were caught in traps at the mouth of the Columbia River, the first recorded from that stream.

The striped bass, far removed from its ancestral home, has maintained the enviable reputation it enjoys in the east, and is freely recognized by its new friends as one of the best food and game fishes of the Pacific coast. It has become a prime favorite with anglers, and I should not be surprised if a vote would show that it is now the leading game fish of California. As every one knows, the striped bass always commands a high price in the east, and is often to be ranked as a luxury; but its abundance in California waters has so reduced the cost to consumers that even the frugal Chinese can afford to eat it, and a comparison made some years ago showed that throughout the year the San Francisco dealers were underselling the New York dealers by many points. The economic importance of the introduction of the striped bass on the Pacific coast may be judged from the following figures:

Entire cost of transplanting less than	$1,000
Annual catch in recent years	1,750,000 lbs.
Value of same to fishermen	$105,000
Aggregate catch to end of 1906	14,960,000 lbs.
Total value to end of 1906	$812,000

CONTRIBUTIONS OF THE WEST TO THE EAST

The fishes which the western states have given to the remainder of the country belong to the trout and salmon family, and up to the present represent only two species that have been actually acclimatized in eastern waters; these are the rainbow trout and steelhead trout. Experiments are now in progress with several other trouts, and, more important, systematic efforts are being made to establish several of the Pacific salmons in New England waters. If this should be accomplished, the fish debt that the west now owes the east for courtesies rendered and benefits conferred will largely be liquidated.

The foremost contribution of the west to the east is the rainbow trout. This fish, which is one of the finest American salmonoids and has long been the subject of fish-cultural operations, is native to the streams of the Sierra Nevada and the Coast ranges. Beauty, large size, rapid growth, hardiness, food value, and game qualities combine to make this a general favorite. By anglers it is usually rated next to the brook trout, although many consider it fully as gamy as the latter fish.

The transplanting of this species in regions east of the Rocky Mountains has been a conspicuous success and has proved a decided boon to many communities. Its acclimatization by the general government was first undertaken in 1880, although it is probable that some years prior thereto small plants had been made in new waters by state commissions or private persons. The rainbow trout has now been introduced into nearly every state and territory, and has become one of the most generally known fishes in every part of the country. In Michigan, Missouri, Arkansas, Nebraska, Colorado, Nevada, and throughout the Alleghany Mountain region, its transplanting has been followed by especially noteworthy results. Its position in the streams and lakes of the eastern states is that of a substitute and not a rival of the brook trout. It is well adapted for the stocking of waters formerly inhabited by the brook trout, in which the latter no longer thrives on account of changed physical conditions; it is also suited to warmer, deeper, and more sluggish waters than the brook trout finds congenial.

The rainbow trout is subject to much

variation, and numerous varieties or species are now recognized. The form that has been most extensively cultivated and disseminated came from McCloud River, in California, the site of the first salmon-hatching work in the west. This stream is fed by melting snows on Mount Shasta, and its picturesqueness is worthy of the beautiful fish it has given to the outside world. The station in the east at which the species has been most largely propagated is at Wytheville, in the Alleghany Mountains of southwest Virginia.

Ichthyologists have not fully decided whether the steelhead trout of the Pacific Coast rivers is a distinct species or only a rainbow trout that has the habits of the salmons. In the west it is classed with the salmons because of its size and migrations; but in the east it has readily taken on the characteristics of a strictly fresh-water species, and has become a competitor of the land-locked salmon. The first successful attempt to bring this excellent food and game fish within reach of the people east of the Rocky Mountains was in 1896, when the planting of fry in rivers at the western end of Lake Superior was begun. In the following year many fine specimens were caught in those streams, and in 1898 fishermen setting nets in deep water for lake trout began to take large steelheads along the American and Canadian shores of the lake, and in the same year fly-fishermen of Duluth caught in French and Sucker rivers not less than 2,000, the largest 28 inches long. The species is now firmly established in Lake Superior and will doubtless in time spread to others of the Great Lakes. The Bureau of Fisheries has recently begun the hatching of eggs from wild fish taken in streams near Duluth. Each season eggs of the steelhead are sent from points on the Pacific coast to stations in the east where the hatching in completed, and the species has obtained a firm hold in a number of New England lakes and has proved an acceptable addition to the fish supply.

A group of trouts of the rainbow series inhabits a circumscribed area in the high Sierra Mountains of southern California in the vicinity of Mount Whitney. All of them are extremely handsome, and two of them, known as golden trouts, only recently discovered by the Bureau of Fisheries, may fairly be regarded as among the most dainty and beautiful of the entire trout tribe. One has been named for that charming writer of western sketches, Stewart Edward White; the other enjoys the distinction of bearing the name of that mighty hunter and fisherman, Theodore Roosevelt. It lives in a snow-fed creek on the southern slope of the Sierras, and its habitat is so restricted and the number of individuals is relatively so few that grave fears have been felt that what is easily possible might quickly come to pass—the complete extermination of the species. The Federal Fishery Bureau has therefore sent to the scene a party which has brought out on the backs of mules, over an extremely difficult, almost perpendicular, trail of 20 miles, a brood stock of golden trout, and has transferred them to various suitable stations at which they will be cultivated. If all goes well, it will be only a few years before anglers in all parts of the country are casting flies for the golden trout, whose gameness equals its beauty.

PACIFIC SALMON FOR EASTERN STREAMS

The most momentous experiments in fish transplanting now in progress are addressed to the Pacific salmons, and perhaps the greatest boon the west is destined to confer on the east is the replenishing of the New England streams with salmon. The physical conditions in the streams that formerly were inhabited by the Atlantic salmon forbid the possibility of ever reëstablishing that species, but it may be that some of the Pacific salmons will find those waters congenial. Trials in the east began with the Chinook salmon—the largest and best of the tribe—and there have been a few encouraging successes reported from the Saint Lawrence basin and from Maine; but it would appear that this species re-

quires conditions that it does not find. Experiments are now in progress with the silver salmon and the humpback salmon—species of little value for canning, but exceedingly good when eaten fresh. Each fall for a number of years several million eggs have been shipped across the continent to be incubated in the Maine and other eastern hatcheries and the resulting young planted in all suitable waters along the coast. These fish require smaller streams for spawning purposes than the Chinook or the Atlantic salmon, and the Bureau is quite hopeful that they will take kindly to many of the coastwise streams of New England, and it is not improbable that some mature specimens may be found in the Maine rivers this season.

ATLANTIC OYSTERS ON PACIFIC COAST

The native oyster of the Pacific coast is a small species, with a strong coppery flavor that persists under all conditions of growth and even after cooking. To a person who is acquainted with the luscious oyster of the east coast, the western species is an unsatisfactory substitute, and there are many people on the Pacific coast whose local pride and persistent effort have not enabled them to overcome their repugnance to it. It was therefore a great boon when, at a comparatively early date, the Atlantic oyster was introduced and took its proper place as the best molluskan food of the Pacific seaboard.

The origin of a very extensive California industry dependent on the eastern oyster is said to have been due to a mere expedient to avoid loss. About 1869 a San Francisco fish firm ordered three carloads of large eastern oysters. This was the first shipment of the kind, and the market was overstocked, so the consignees were obliged to dump a part of the cargo in San Francisco Bay. The oysters thrived and subsequently yielded a handsome profit; and this enforced experiment has led to an important trade, and to the inauguration of a system of oyster culture that has remained unique.

A number of oyster-planting companies are now engaged in bringing one- and two-year old oysters from New York and vicinity and planting them in various parts of San Francisco Bay, where large areas are now devoted to the cultivation of this mollusk. The oysters grow rapidly, retain their native flavor, and are marketed at very remunerative prices after being on the beds for two and three years. The supply is chiefly kept up by annual replenishment from the east, the oysters being brought in refrigerator cars holding 150 to 200 barrels; some seasons the shipments have amounted to 100 or 125 carloads.

The planting grounds are surrounded by substantial stockades, which serve the twofold purpose of keeping out poachers and preventing the destruction of the oysters by sting-rays, large schools of which visit the bay at certain times each year. The plantations are overlooked by watch-houses on piles, which are headquarters of the men employed in the working of the beds. As required, the oysters are tonged into large scows and transferred to floats, in which they are retained while being culled. Oysters large enough for sale are placed in boxes or sacks and shipped to market, while the small oysters and the shells are replanted.

California enjoyed a monopoly of this industry for many years. In 1894 the Bureau of Fisheries made a successful plant of 80 barrels of eastern oysters in Willapa Bay, Washington, and demonstrated to the people of the northwest coast the possibility of growing to marketable size in their waters oysters brought from the Atlantic. Private companies have now undertaken the business in Willapa Bay, Puget Sound, and several other points in Washington and in Yaquina River in Oregon, and the outlook is quite favorable for the development of a remunerative trade.

The one drawback to the complete success of this business is the necessity for depending on the east for keeping up the supply. This is particularly true of Oregon and Washington, where the

water is too cold to permit the eggs of the transplanted oysters to develop. In San Francisco Bay, owing to the warmer water, a small but apparently increasing proportion of the output represents oysters that have been produced locally.

How large a factor in the Pacific states fisheries the Atlantic oyster has become may be appreciated when it is stated that it is exceeded in value by only the salmons, and that the annual output now reaches $600,000 to $700,000.

The soft-shell clam, accidentally carried across the continent with the oyster, has thrived well; has been retransplanted from California to Oregon and Washington, and is now yielding the fishermen an annual income of about $30,000.

UNITED STATES FISHES IN OUR INSULAR POSSESSIONS

It seems to be pretty definitely understood now that the American Constitution does not necessarily follow the flag. In this respect it differs from American fishes, of which quite a number of species have already become established in our insular possessions and are enjoying all the privileges accorded them at home, while various others will doubtless in time prove valuable additions to the fauna of Porto Rico, Hawaii, and the Philippines.

While the fresh waters of the Hawaiian Islands are too small and unstable to permit very extensive results from acclimatization, experiments have been conducted with quite a number of species. A single attempt to establish the large-mouth black bass has been unsuccessful, but there is reason to believe that this fish may do well in some of the ponds. Bullheads from California have been planted in the same waters, and should easily be established if desired. Frogs, introduced as early as 1879, have become abundant on several of the islands and are now reaching the Honolulu market. Besides their value as food, they have proved beneficial to cattle-growers by consuming large numbers of fluke-worms inhabiting the shores of the ponds and pools.

An especially interesting case of fish acclimatization in outlying territory was the recent planting in the rice fields of the Hawaiian Islands of several thousand viviparous and other minnows from Texas, for the purpose of destroying mosquitoes. The mosquito-eating propensities of these species at home are well known, and it is reported that the fish have given a good account of themselves in Hawaii.

In the spring of 1907 a consignment of large-mouth black bass left San Francisco for the Philippine Islands, where the fish will be planted in closed waters pending a determination of the best points at which to liberate them and their progeny.

Among the Asiatic fishes now commonly found in the Hawaiian Islands are the carp, the gold-fish, a cat-fish, and a serpentheaded-fish—all introduced by Chinese or Japanese and used chiefly by those people. The carp and the gold-fish have also been introduced by them into the Philippines.

FOREIGN FISHES IN THE UNITED STATES

The introduction of foreign water animals into the United States has been much less extensive than the importation of plants and land animals, the primary reasons for this being the greater difficulties of transportation and the all-sufficient richness of our own waters in almost every kind of products. Quite a number of Old World fishes have been successfully planted in our waters, and some of them have become very well known in various parts of the country. The introduction of several others has been attempted, but has met with failure.

Two of the best-known European trouts—the brown trout and the Scotch lake trout, or Loch Leven trout—have been cultivated in the United States for a score of years by both national and state fishery bureaus. These fish have been planted chiefly in private waters, some of which have been well stocked;

but they are not so highly regarded or so valuable as our native trouts, and the demand for them is decreasing. The Swiss lake trout has been handled on a small scale for some years, and recently has been planted in some of the Adirondack lakes—very appropriate waters, where it should prove a valuable addition to the supply of game fishes. A number of fine, large examples have recently been caught, and the success of the plants seems assured. The sea trout of Europe, whose migrations to and from the rivers are quite similar to those of the salmon, has been under semi-domestication in New England for many years, and is now being cultivated in ponds at a number of places. The fish are not permitted to run to sea, but this enforced change of habit does not appear to influence them very unfavorably. As food and game they have no advantages over native species, and probably all that can be said in their favor is that they add to the variety of fishes useful for the stocking of private preserves or lake systems.

Other Old World fishes now very familiar in this country are the gold-fish or golden carp, the golden ide or golden orfe, the tench, and the paradise-fish. The gold-fish is native to China and Japan, where it has been cultivated for centuries, and it is now domesticated in nearly every civilized country. Many millions are raised annually by amateurs and professionals in the United States, and the money value of the gold-fish industry is really very great. The gold-fish and the golden ide are used almost wholly for ornamental purposes, although both have in some places escaped into ponds and streams and are occasionally seen in the markets. After a few generations in a wild state, the gold-fish loses its bright colors and reverts to the dull brown color of its Asiatic ancestors. The tench is a handsome species, with a rich brownish-green color and very fine scales; it is found in some numbers in the Potomac and perhaps in other streams, and it is now reaching the Washington market in small quantities, but its sluggish habits and carpish affinities will probably never permit it to attain a high reputation in this country, although it is esteemed in Europe, and is really a first-class table fish when taken from suitable waters. A pretty cultivated variety, of a bright golden-yellow color, with a few round brownish-red or blackish spots, is desirable for aquaria and fountains. The paradise-fish, a native of Burma, is a small aquariam species with interesting breeding habits.

THE CARP

The best-known, most widely distributed, and most important of our fish immigrants is the carp, usually called the German carp, a native of Asia, but cultivated for many centuries in Europe, whence were brought to this country about 30 years ago the improved varieties—the leather carp, blue carp, and mirror carp.

The carp has received an extraordinary amount of criticism, mostly unfavorable, during recent years; no other fish, in fact, has ever come in for so much vituperation. In some communities the carp question has at times overshadowed the tariff, the trusts, and high finance; and there are places where it is almost as much as a man's life is worth to raise his voice or lift his pen in favor of this Mongolian alien. Without entering into a discussion of the carp question and without undertaking to make any apology for the carp, it may be said that most of the attacks on its reputation have been unfair, and that a better knowledge of the objects and results of the introduction of the fish into American waters would greatly reduce the number of people who place the carp in the same category of nuisances as the English sparrow. Although small numbers of carp were imported by private individuals before the introduction and distribution of the species by the general government, the latter was solely responsible for the present continental distribution of the fish, and to it, as represented by the National Fish Commission, must be ascribed

whatever credit or blame is due. In his 1878 report to Congress, Professor Baird said:

"The carp has been domesticated in Europe from time immemorial, and represents among the finny tribe the place occupied by poultry among birds. It is a fish adapted to the farmer's ponds and to mill-dams, less so to clear, gravelly rivers with a strong current. Where there is quiet water, with muddy bottom and abundant vegetation, there is the home of the carp; there it will grow with great rapidity, sometimes attaining a weight of three to four pounds in as many years. It is a vegetable feeder and not dependent upon man for its sustenance. As an article of food, the better varieties rank in Europe with the trout, and bring the same price per pound."

The limitations of the carp, as thus defined and as recognized and acknowledged at the time of its introduction, have been to a great extent overlooked or ignored, and to this is to be attributed much of the carp's disrepute. It has been planted under conditions as inappropriate as would be the stocking of a game-bird preserve with foxes or the raising of rabbits in a meadow overrun with hounds.

The indictment against the carp in America is long and formidable. It is charged with being unfit for human food, with being very injurious to other and better fishes, and with being very destructive to ducks and other wild fowl by uprooting the wild celery on which they feed, to say nothing of various minor accusations.

It is not necessary to discuss these points, and it will suffice to say (1) that special investigation has shown the carp does exceedingly little harm to any other fish, as any one would expect from its known habits and anatomical peculiarities; (2) that the injury done to the feeding grounds of wild fowl has been grossly exaggerated; on one hand, a scarcity of ducks may occur entirely independently of the presence of carp, and, on the other, a great abundance of carp may be coexistent with an undiminished growth of wild celery; and (3) that the carp is a food fish of very great importance, and to say anything to the contrary is to ignore facts.

We may profitably dwell a little on this last point, because a few people are aware of the economic value of this fish at the present time or appreciate the role it must inevitably continue to play in this country, for the carp is already the most widely distributed American fish; it can no longer be regarded as an alien; and it is here to stay.

As a food fish the carp has many superiors. I do not eat it and see no reason why people so favorably situated as are those who live on the seaboards, the Great Lakes, and the various interior waters should eat carp; but there are millions of our people who can not obtain the delicious trout, shad, salmon, black bass, striped bass, halibut, mackerel, or smelt; or who, if they ever see these fish, find them, like the peas porridge of the nursery rhyme, "nine days old" or more and nine times inferior to a fresh carp. It is to the many people who must eat carp or no fish, or no better fish, that this food comes as a special boon, although the consumption, even in many of the eastern seacoast towns, is surprisingly large.

"The proof of the pudding is the eating"—one of the proofs of a fish is the price people are willing to pay in order to eat it. Judged by this standard, the carp is to be reckoned among the leading fishes of the United States. It is regularly exposed for sale in every large city and in innumerable small towns; and the fishermen find such ready sale for it at such good prices that in at least 15 states special carp fisheries are carried on, and in 35 states it is regularly taken for market. At this time the annual carp catch amounts to about 20 million pounds, for which the fishermen receive $500,000.

Illinois is not only the "sucker state"; it is preëminently the "carp state", and is not ashamed of the fact. It produces twice as many carp as any other state,

and its fishermen have for years been reaping a golden harvest, finding a ready sale in the west and also sending large consignments to New York in special cars. The next important center is the western end of Lake Erie, in Ohio and Michigan, where large special ponds have been constructed and a peculiar form of cultivation has sprung up. The ponds are designed primarily for retaining carp that have been seined in open waters until the price warrants shipment, and some of them have to be kept at a proper level by pumping or by the use of water elevators. The expense involved in the construction and maintenance of such works shows how remunerative the carp is. Other important carp states are Colorado, Delaware, Iowa, Minnesota, Missouri, New Jersey, New York, Tennessee, Utah, and Wisconsin.

It is not as a great market fish, however, that the carp is destined to attain its highest importance among us, but as a fish for private culture and home consumption. The number of farmers and small land-owners who are alive to the benefits of private fish ponds is increasing at a very rapid rate, and hundreds of thousands of such in all parts of the country, but particularly in the great central region, will find in the carp the species best adapted to their needs and conditions.

It is probable that the commercial value of carp is insignificant compared with its importance as a food for other fishes. It is extensively eaten by many of our most highly esteemed food fishes and is the chief pabulum of some of them in some places. In a number of the best black-bass streams, like the Potomac and the Illinois, the carp is very abundant and is a favorite food of the young and adult bass, while in California the introduced striped bass has from the outset subsisted largely on carp and may owe its remarkable increase to the presence of this food.

The consumption of carp is certainly destined to increase greatly; but even if the catch reaches no higher point, the introduction of the carp into the United States will remain the leading achievement in fish acclimatization in recent times, and, with the exception of the original introduction of the same fish into Europe from Asia, the most important the world has known.

American anglers for bass and trout and salmon, as a rule, have only contempt for the carp, and there is nothing so calculated to disturb the equanimity of the otherwise amiable disciples of Walton as the mention of carp. It is my firm conviction that the true basis for most of the unfriendly feeling toward the carp is the fact that this fish does not habitually rise to a fly and is not fitted by nature to inhabit the purling brook, the foaming cataract, the glacier-fed rivers, and the bottomless lakes where the fly-caster is wont to go. And yet to hold that the carp is beneath the attention of sportsmen is to ignore well-known facts and to acknowledge indifference to the classical tenets of angling. From earliest times the carp has been a favorite with the anglers of Germany and England; Isaac Walton himself devoted a chapter to it, and called it "the queen of rivers; a stately, a good, and a very subtile fish"; Cholmondeley-Pennell has shown that it is at times as fastidious a biter as a trout or bass; and Professor Goode has protested against the dictum of New World authorities in excluding from the class of game fishes the carp, the dace, the roach, and other pets of the father of angling, classical in sportsmen's literature, and affording "sport, which in England tens of thousands enjoy, to every one who gets the chance to whip a salmon or trout line over preserved waters."

THE FAILURES

In view of the foregoing splendid record of achievement, we should not be loath to acknowledge a number of failures to establish certain fishes and other water creatures in regions in which they were demanded and to which they appeared to be entirely adapted.

Between 1878 and 1888 five attempts

to introduce the English sole and turbot on our Atlantic coast were unsuccessful, owing probably to the comparatively small number of fish brought over and planted. There is no reason to doubt that these species could be readily established on our northeast coast, although it must be said that the sole and turbot, choice food fishes as they are, would not be unrivaled additions to our flat-fish fauna.

One of the most surprising failures has been the entire inability to establish the whitefish of the Great Lakes in Pend d'Oreile, Cœur d'Alene, and other large lakes of the northwest. Depth, temperature, and other conditions seem to be favorable, but for some unknown reason plants aggregating millions have been futile.

There is probably no food animal of the eastern seaboard whose acclimatization on the Pacific coast would prove such a boon as the lobster. The omission of the lobster from the Pacific fauna is regarded as a misfortune by the people of the west coast, and it was in response to this feeling that the Federal Fishery Bureau more than 30 years ago made its first move to supply the deficiency. Three other transhipments of adult lobsters were made, the last in 1889, the deposits being at various points from Monterey Bay to Puget Sound. No positive results having appeared, the Bureau renewed the attempt in the fall of 1906, and dispatched to Puget Sound a special carload of brood lobsters numbering more than all the previous plants combined, and further consignments will be made until the lobster is removed from the list of failures and recorded as a great financial and gastronomic success.

FURTHER WORK OF ACCLIMATIZATION

What opportunities and what necessities for further fish acclimatization the future has in store can only be conjectured, but there is no reason to believe that additional work will not become desirable, as a result of the depletion of waters of their native fishes, changes in the physical conditions of streams and lakes, etc., and to satisfy the longing for something new and something better that, like hope, "springs eternal in the human breast."

Among the measures that have been suggested and will no doubt in time be taken up are the transplanting of the diamond-back terrapin and the blue crab in the marshes and bays of California and the establishing of the giant crab of the Pacific coast along the shores of the North Atlantic states.

Foreign waters also may be drawn on to augment the supply of economic animals and to fulfill certain special requirements. Objects which have been under consideration are the Japanese dwarf salmon, the Japanese pearl oyster, and the Japanese edible oyster, the last being recommended for the cold waters of the northwest coast, where the Atlantic oyster is not able to perpetuate itself.

It has been suggested that the finer grades of Mediterranean toilet sponges might profitably be introduced into the waters of Florida, and the British government has considered the same project with reference to the Bahamas. Now, for all ordinary purposes, there are no better sponges produced anywhere in the world than on the gulf coast of Florida. The Florida sheepswool combines all the desirable qualities of a toilet sponge—softness, elasticity, durability. Another native sponge of excellent quality is the fine-meshed, smooth-surfaced yellow sponge, which ranks next to the sheepswool in economic value; but for special purposes some of the small, fine-textured, soft, Mediterranean sponges have no substitute, and large quantities are imported. Whereas the best Florida sponges command a maximum price of $5 per pound wholesale, the Levant toilet sponges sometimes sell for $50 per pound. It would be a splendid achievement to introduce such sponges and enable our own people to reap some of the benefits of so lucrative a fishery. The questions involved in the project are: (1) Can the sponges be successfuly transported from

southern Europe to Florida? and (2) Will the transplanted sponges retain their original qualities in a new environment, or will they, after a few generations, take on the harsh characters of the analogous Florida species, which are not at all suitable for toilet purposes?

It is quite remarkable that the cheapest and least useful of the Florida sponges—the so-called grass and glove sponges—should physically and commercially differ so markedly from their Mediterranean prototypes, while biologically they are so closely related.

While the transportation of living sponges from so great a distance certainly involves difficulties, they are perhaps not insurmountable. Experiments conducted by the Bureau of Fisheries have shown that sponges may safely be kept out of the water for 3 days, provided they are cool and moist—and it is probable that this time can be considerably extended under favorable conditions—while the installation of a small circulating plant on an ocean liner may make the transportation still easier. As to the other question, time alone can determine.

The project involves the cultivation of the imported sponges, and for this the Bureau has already prepared the way.

FISHES THAT BUILD NESTS AND TAKE CARE OF THEIR YOUNG*

THE belief long prevailed that fishes are indifferent to their eggs and young and leave them entirely to the care of Mother Nature. One who was more excellent as a man of letters than as a naturalist, but who wrote, nevertheless, a very readable work on Animated Nature, Oliver Goldsmith, in 1774, told his readers that "fishes seem, *all* except the whale kind, entirely divested of those parental solicitudes which so strongly mark the manners of the more perfect terrestrial animals." Many to the present time entertain that belief.

More than a score of centuries before Goldsmith, however, the greatest naturalist of antiquity, Aristotle, told of a kind of fish, inhabiting the largest river of Greece, the Macedonian Achelous, which, in the person of the male parent, exerted the greatest care of both eggs and young. That account, however, was overlooked or neglected, and even regarded with skepticism and as fabulous. The strange history of that fish—known to Aristotle as the glanis—will be told at length in later pages of this article. Its truthfulness has been vouched for, not by later observers of itself, but by studies of related fishes having analogous habits in a quarter of the world unknown to and undreamed of by Aristotle. Although the most detailed history of any fish by any ancient writer is connected with it in the philosopher's History of Animals, no reference to it appears in any modern popular work.

Many important details respecting the life histories and parental care of a large number of other fishes have been published from time to time and may be found in the publications of various societies or other periodicals, but such are closed books to most persons. Anyone who looks for information in the popular works on natural history of the day must inevitably be disappointed at the meagerness of the information given. Even in the voluminous German work, so well known as Brehm's Tierleben, the infor-

* This article is abstracted from "Parental Care Among Fresh Water Fishes." By Theodore Gill. Smithsonian Institution, 1907. Dr Gill's paper makes a monograph of about 125 pages, and contains many illustrations. It is full of facinating and new information on the subject.

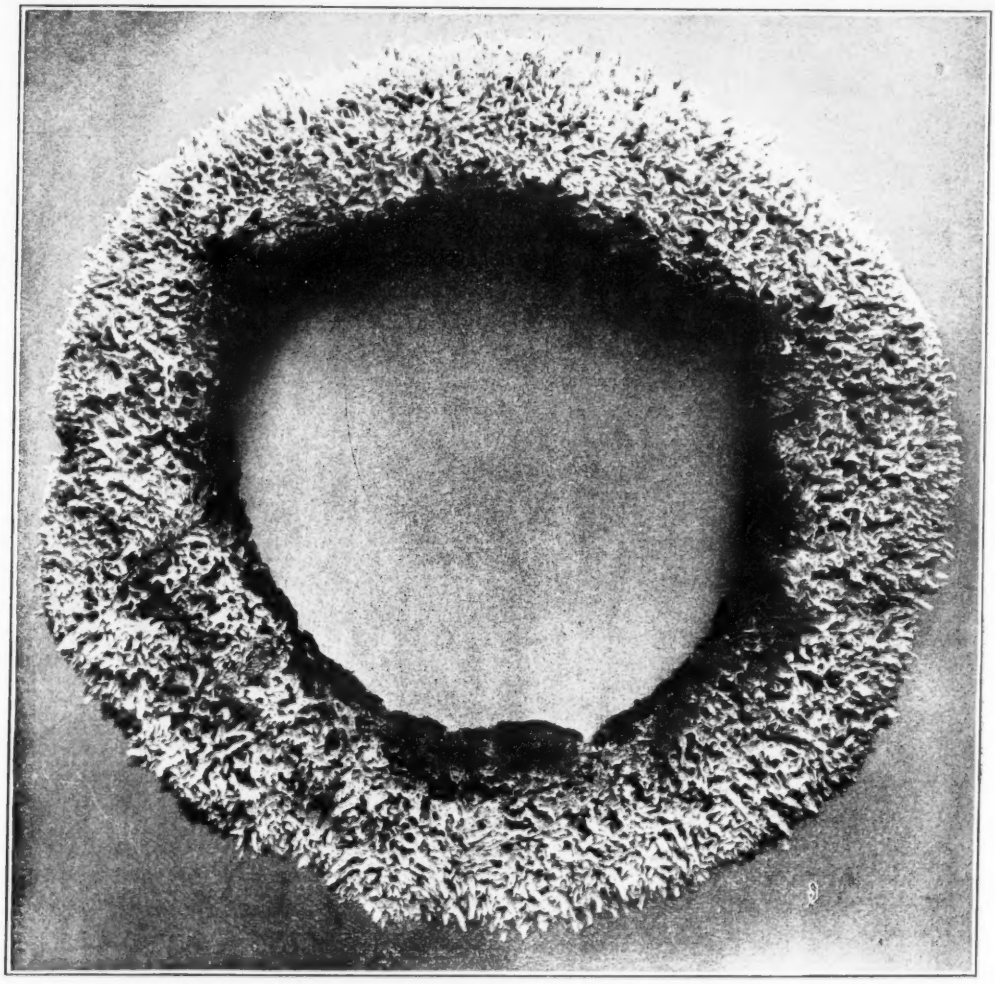


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

A Sheepswool Sponge of an Unusual Shape

From Matecumbe Key, Florida. Diameter of wreath, 30 inches; width of sponge proper, 7 inches; weight (dry), 1 pound 7 ounces. The sheepswool is the best sponge found on the shores of the western Atlantic, and, while coarser in texture than the best Mediterranean sponges, it is more durable (see page 399)

mation is meager for almost all fishes, and especially meager for American forms. The sources of knowledge have not been discovered by the compilers of such works, but he who might judge from the paucity of data that no others could be found would be much deceived. To uncover some of the interesting details hidden in comparatively little known journals and other works is the object of the present article.

The species which manifest care for their young are so numerous that the present article must be restricted to those which are inhabitants of fresh water. Such are better known than the marine

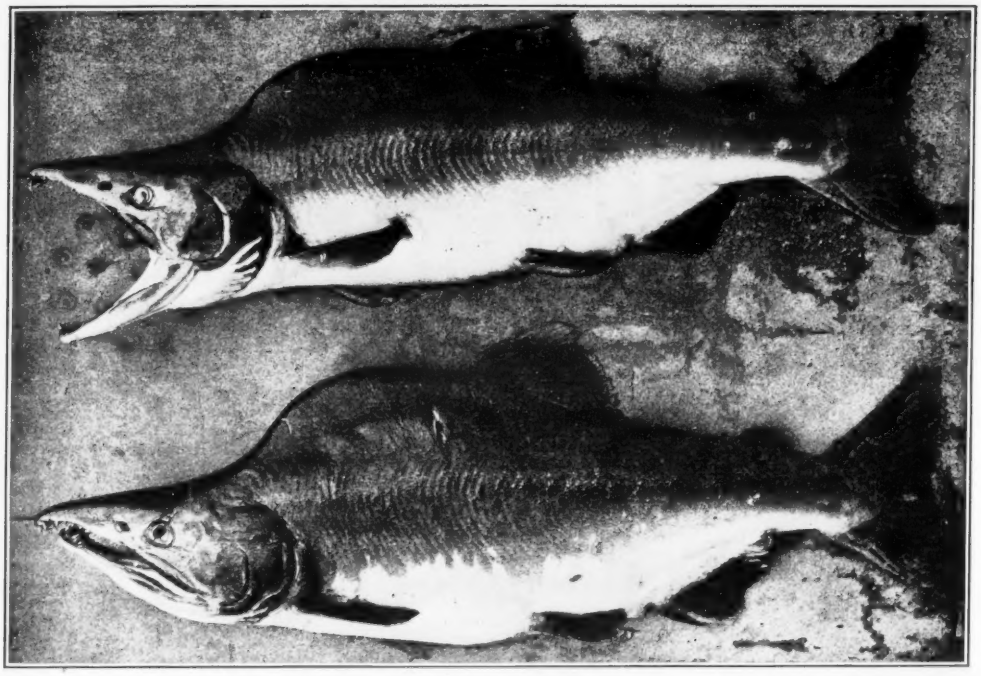


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

Humpback Salmon from Alaska

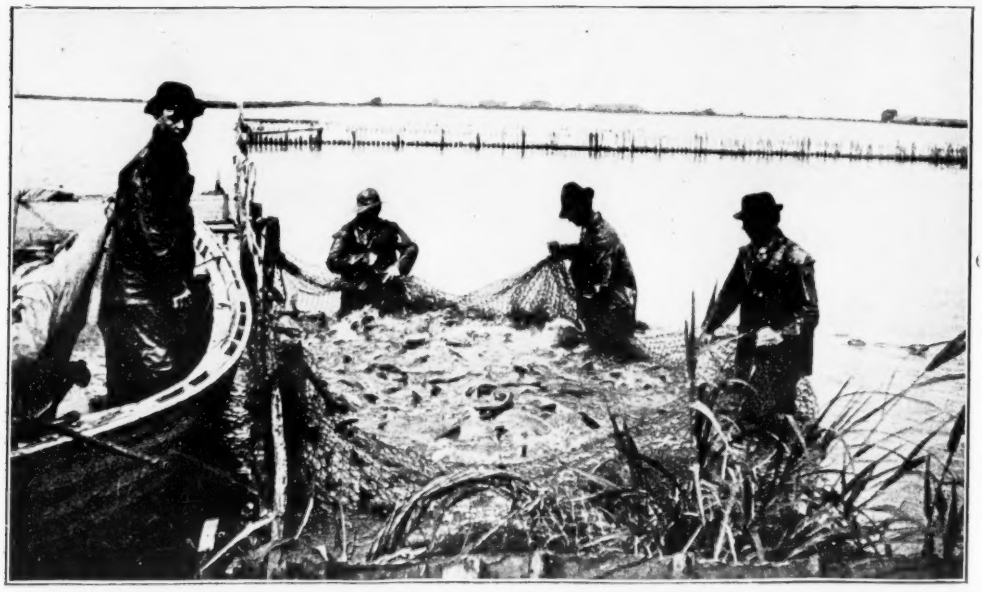
Showing excessive development of the hump in males during breeding season. The introduction of this species into New England streams is now in progress (see page 393)

forms, as they are more easily observed and within the range of observation of a more numerous population. Considerable is known, however, of the habits of many of the dwellers in salt water. Parental care has been especially observed in the marine pipefishes, sea-horses, Pegasids, Solenostomids, Sparids (*e. g., Catharus*), Labrids (Wrasses), toad fishes, gobies, blennies, sculpins or Cottids, lumpfishes, Gobiesocids, etc.)

Naturally the most common or frequent mode of care is the simplest, consisting of little more than selection of a site for the deposit of the female's eggs and subsequent guardianship of those eggs by the male. In the case of the American sunfishes, black basses, and crappies, the place selected is cleared of stones and weeds, and in the cleared place the eggs are laid. Some of the sunfish-like Cichlids and the North American catfishes, as well as the Grecian glanis, exercise similar means with slight modifications. Another kind of catfish, living in North Australia (Queensland), lays her eggs in the center of a selected area of a river bed, and, after having fertilized them, the fish accumulates stones from the surrounding area and piles them in a heap over the eggs.

ARISTOTLE'S CATFISH

Aristotle 2,250 years ago described how this fish guarded its young, but the world for nearly as many years has laughed at his story. Recent investigations by Dr Theodore Gill, and others, of a similar fish in the United States, have



Seining Carp from a Pond—Sandusky River

The German carp has become exceedingly abundant in the western part of Lake Erie, where millions of pounds are caught annually (see pages 396–7)

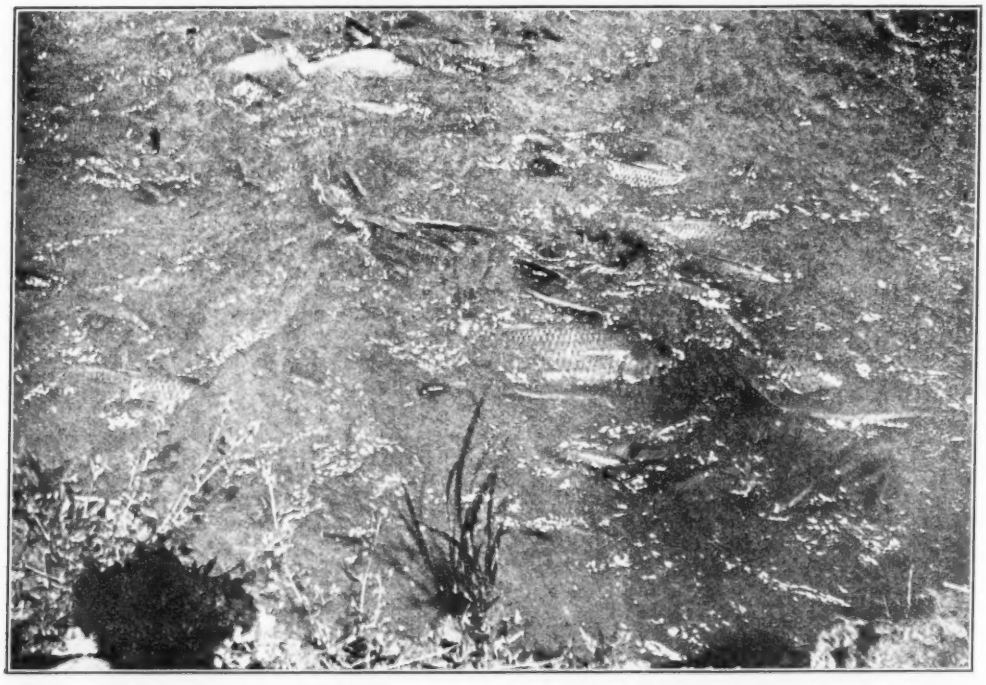


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

School of Carp Swimming against Inflowing Water, in Pond at Port Clinton, Ohio

Carp seined in open waters are retained in large enclosures or ponds until the condition of market warrants shipment (see pages 396–7)

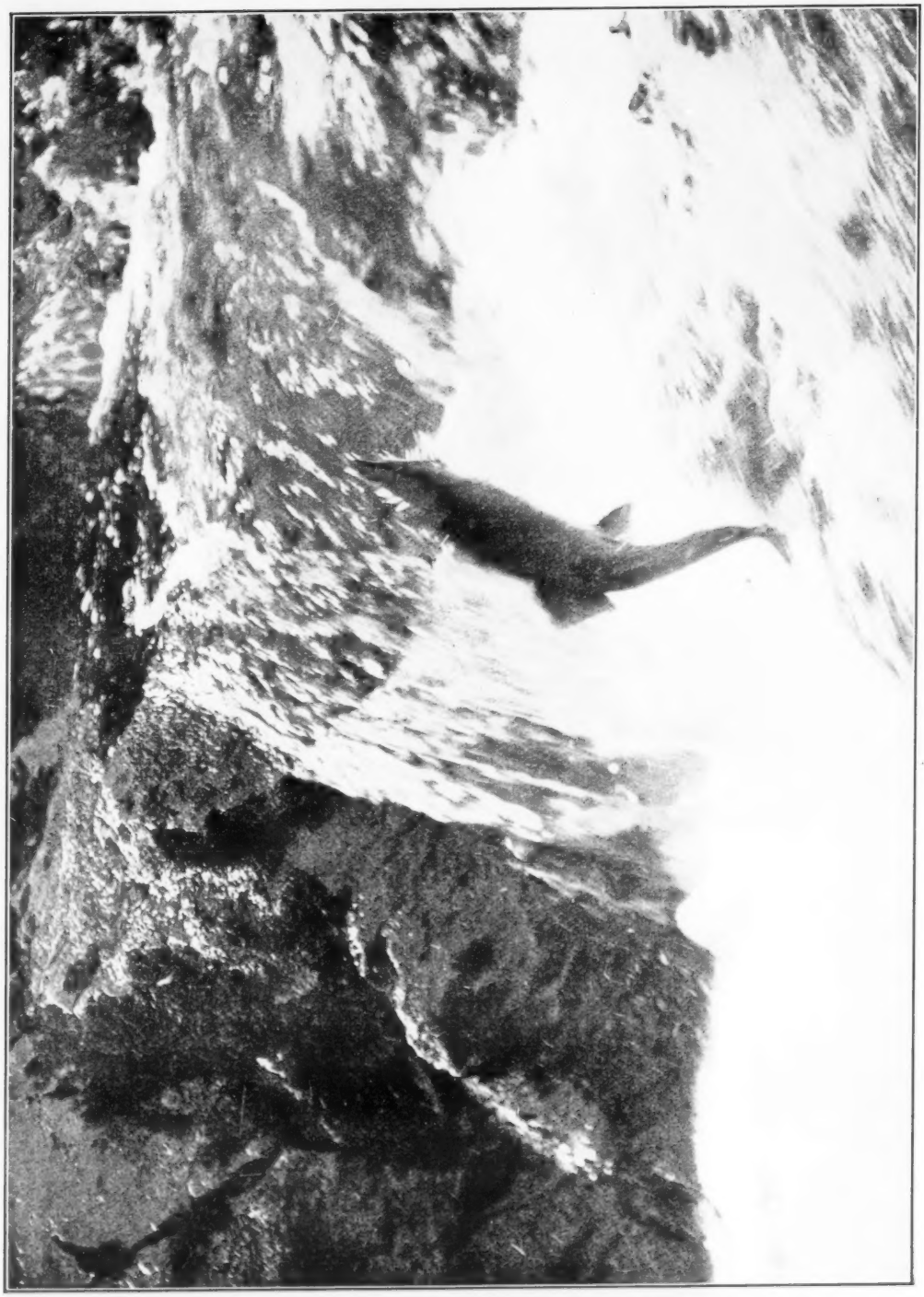


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

Salmon Ascending a Stream in Search of Spawning Ground

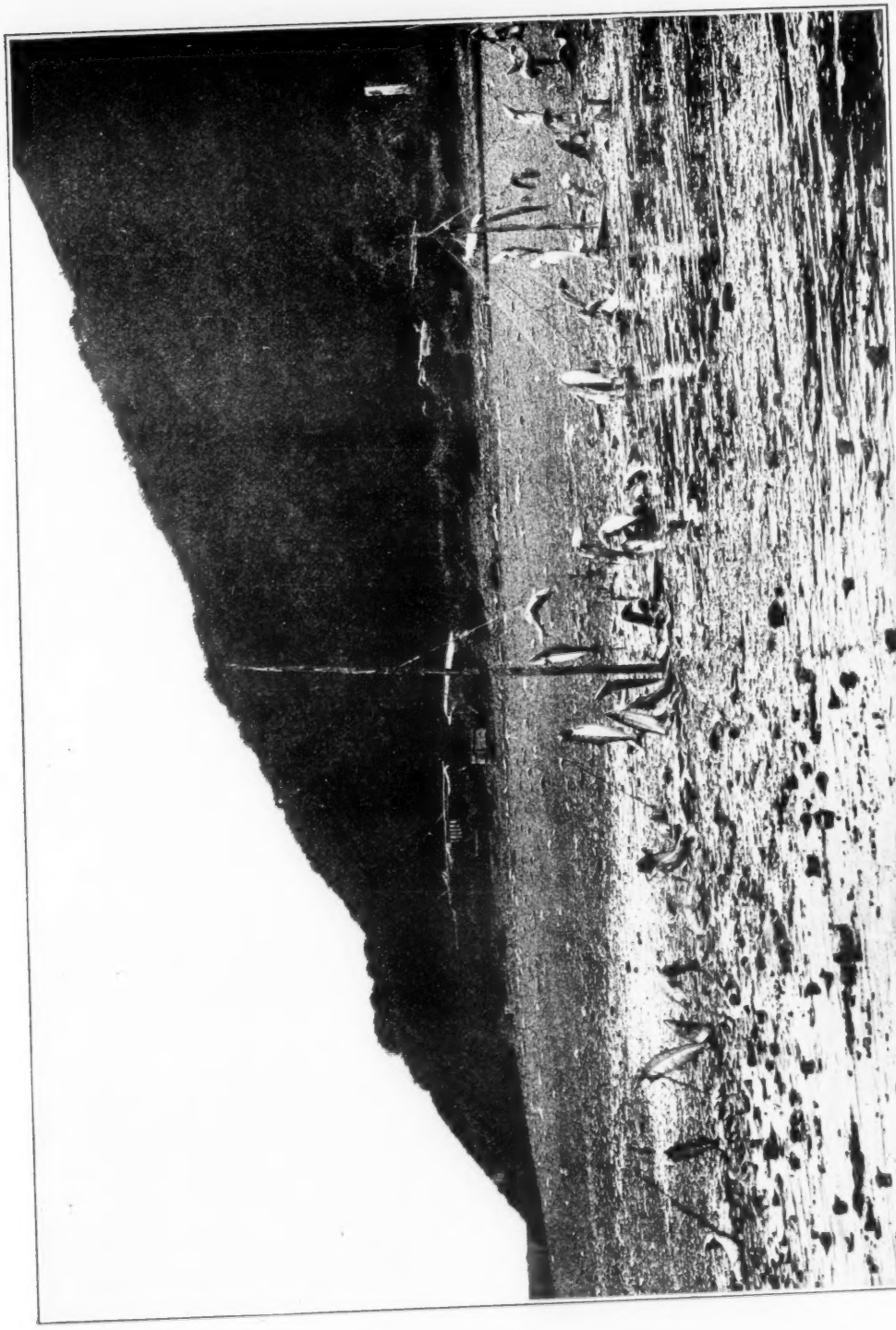


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

Salmon Caught in a Weir—Alaska

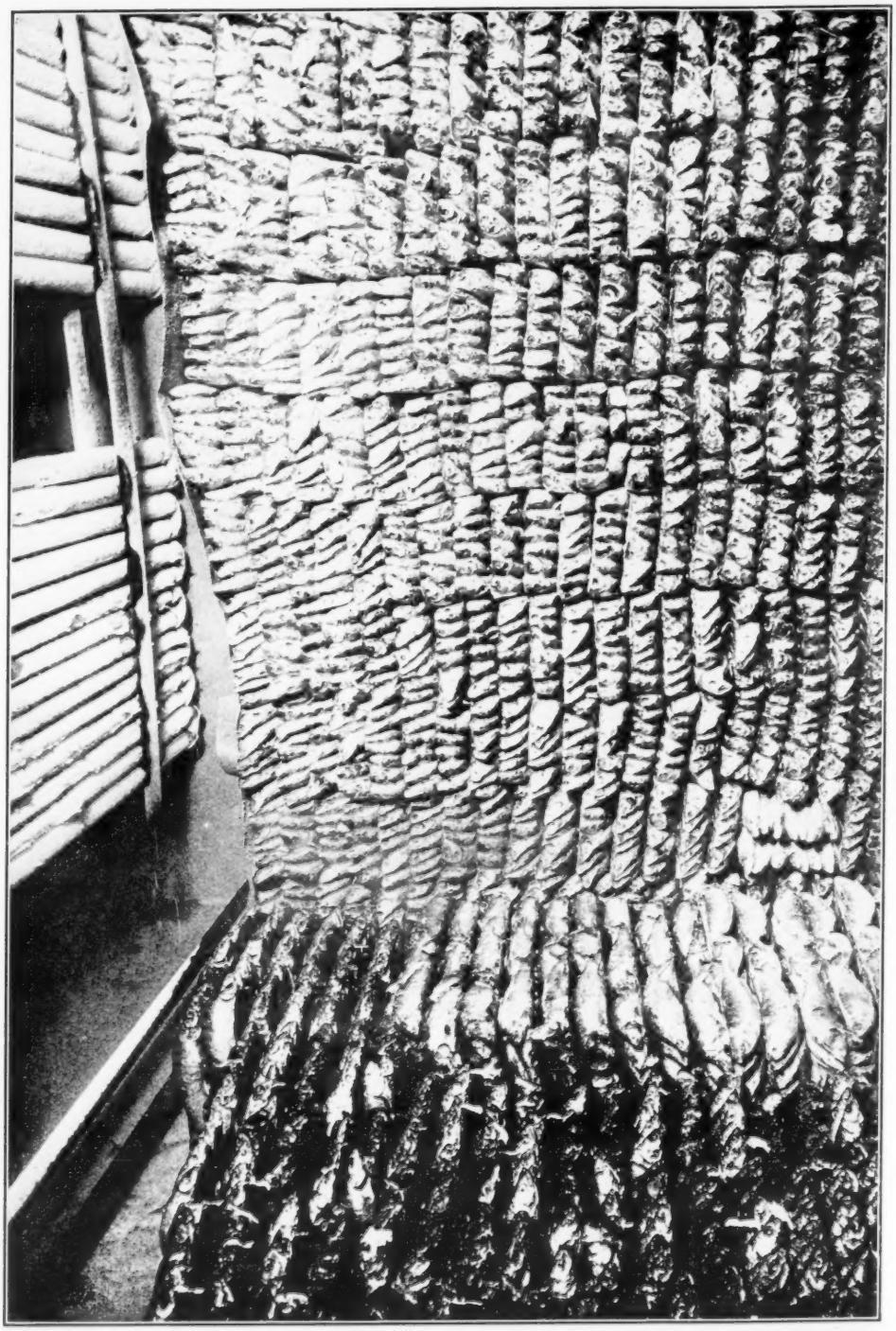
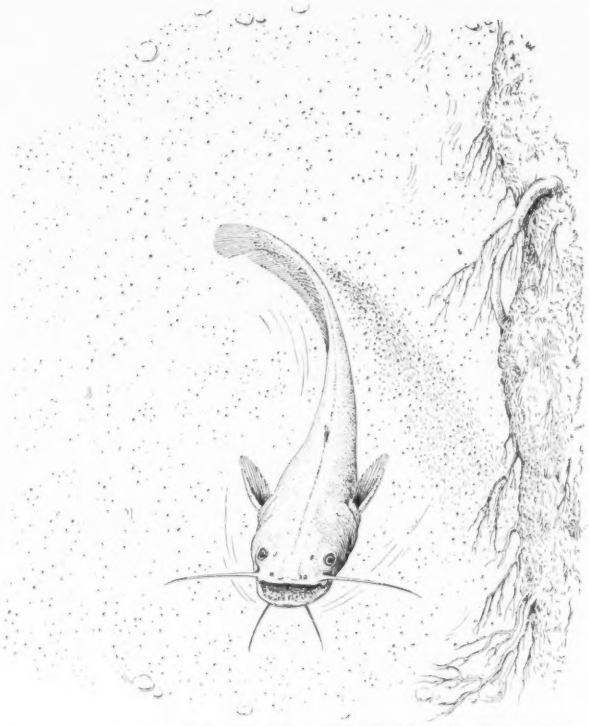


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

Lake Herring Stored in a Refrigerating Plant

proved that the famous Greek philosopher told the truth. Aristotle wrote as follows (Book IX, Chapter 25, Section 6):

"Of the river fishes, the male glanis takes great care of its young. For the female, having brought forth, departs; but the male, where the greatest deposit of eggs has been formed, remains by them watching, rendering no other service except keeping off other fishes from destroying the young. He does this for forty or fifty days, until the young are sufficiently grown to escape from the other fishes. And he is known to the fishermen wherever he may chance to be watching his eggs; for he keeps off the fishes by rushing movements, and by making a noise and moaning. And he remains by the eggs with so much of natural affection that the fishermen, when the eggs adhere to deep roots, bring them up to the shallowest place they can; but he does not even then leave his offspring, but if he chance to be a young fish he is easily taken by the hook, because he snaps at all the fishes that approach him; but if he is already accustomed to this, and has swallowed hooks before, he does not even then desert his young, but breaks the hook by a very strong bite."



From Theodore Gill, Smithsonian Institution

Aristotle's Catfish (*Parasilurus Aristotelis*) on Nest (Ideal)

THE AMERICAN CATFISH

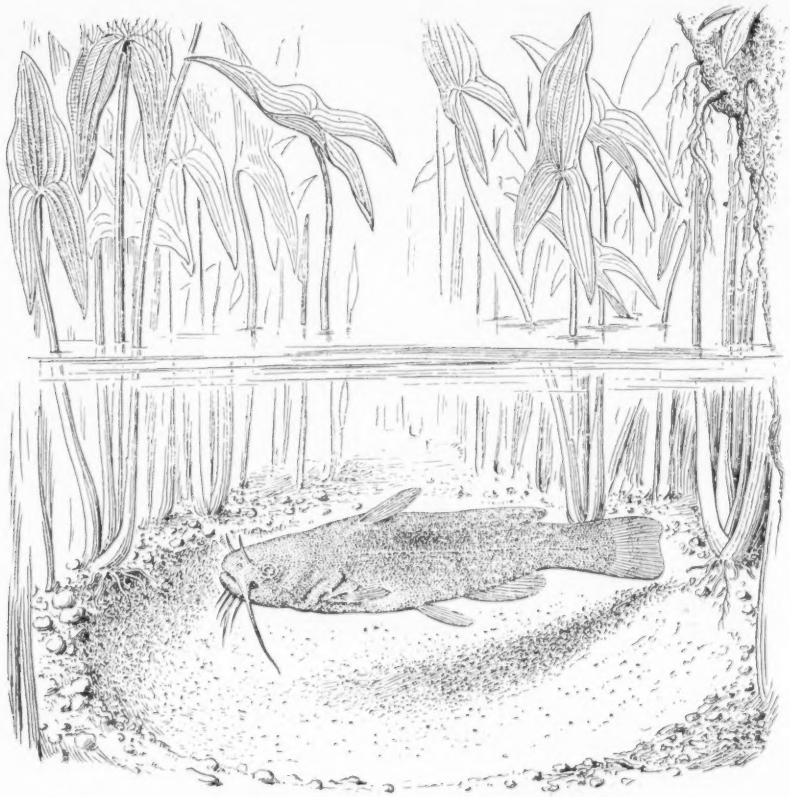
In cleaning out a nest, this catfish carries off pebbles from ½ to ¾ of an inch in diameter. Dr Hugh M. Smith thus describes the nest-building of a pair of catfish in an aquarium: "The pair of fish, during the first night they were in the aquarium, removed all the gravel from over a space nearly 2 feet long and 1 1/3 feet wide, upward of a gallon of stone being transferred to the end of the tank." A pint or more of gravel was then scattered on the nest by an attendant, but in a few minutes the fish had completely freed the nest again.

The male remains on guard for several weeks after the eggs are hatched, to protect the young fish.

THE BOWFIN OR MUDFISH

The bowfin is a strong and well-armed fish, both as to the bony armature of the head as well as the teeth. It is one of the large fishes, when fully mature attaining a length of over 2 feet, often 2½, or even somewhat more. As usual among fishes, the females average larger than the males. The males, apparently, are much more numerous.

The geographical range of the bowfin is quite extensive, and yet restricted in a peculiar way. It is not found in the New England States (except in Lake



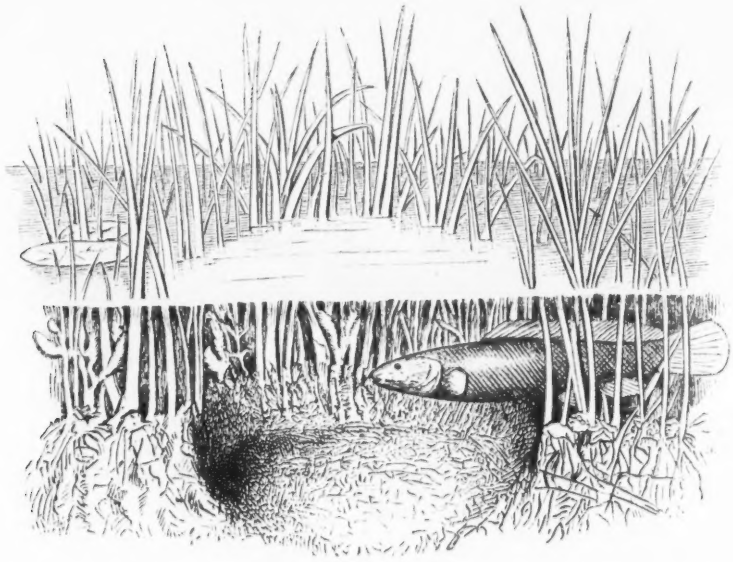
A Typical American Catfish (*A. nebulosus*) on Nest (Ideal)

Champlain) nor in the waters, flowing eastward, of the Middle States, but it is an inhabitant of the Great Lakes (except Superior) and of the Mississippi Basin, as well as of the Southern States up to Virginia and the Dismal Swamp.

Sluggish waters are its favorite haunts, and a couple of its names—mudfish and marshfish—indicate places in which they may be found.

The male constructs the nest unaided, scooping out the depression by rotating its body, and breaking young shoots with its snout. After the nest is constructed it awaits the coming of a mate.

The stock of eggs being provided, the male bowfin redoubles his guardianship. "At intervals he moves over the nest and *by the movements of his fins keeps the eggs free from sediment, which would otherwise smother them.*" *All the time he is on the outlook for intruders, and especially against other males.* One Reighard saw rushed at another male and "struck him with his head in the middle of the side and hurled him two feet from the nest." Generally there is no contest, for the rights of the nest-maker appear to be respected, but occasionally too great aggressiveness on the part of the occupant or audacity of an intruder results in a regular battle. Whitman and Eycleshymer tell of one: Two males that claimed a female were unwilling to yield one to the other, and "a fierce battle for supremacy ensued" between them. "They approached from opposite sides of the nest and locked jaws in a most ferocious manner. Their struggles were so violent that a cloud of muddy water soon arose



Nest of Bowfin, Commonly Known as the Dogfish or Mudfish.. After Dean

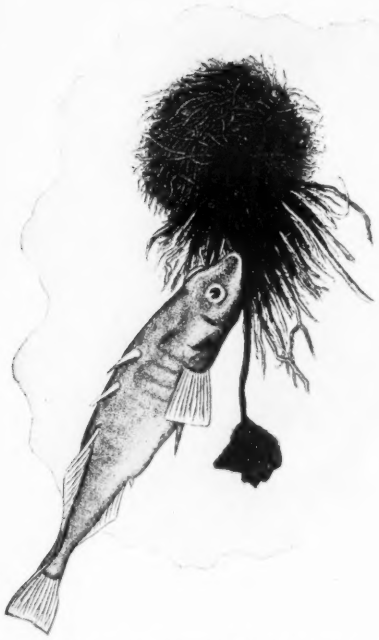
and obscured them from view." Eventually one of the males was left about the nest, and his attentions were accepted by the female, who, "during the battle, had remained concealed at the side of the nest."

A FISH WHICH MAKES A FLOATING NEST

The gymnarchus makes a large floating oblong nest, about 2 feet long and 1 foot wide on the outside, in the dense grasses of a swamp and in water 3 to 4 feet deep. In one, especially described by Budgett, "three sides of the nest projected from the water; the fourth side was several inches lower, being about two inches below the surface. The deepest part of the nest was opposite to that side where the wall was low, the bottom being about six inches below the surface of the water."

In one nest "were deposited about a

Floating Nest of *Gymnarchus,* which Inhabits the White Nile, the Senegal, and Niger Rivers and Lake Chad, in Africa. After Budgett



Three-spined Stickleback

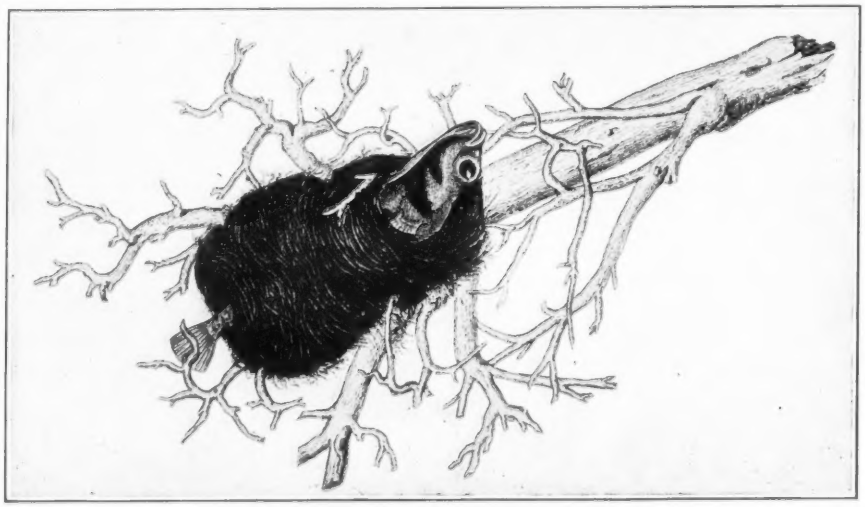
Male laying the foundation of his nest, which would do credit to a bird. The fish glues together the pieces of which the nest is constructed with a spider-like thread, which it manufactures. After Coste

thousand spherical amber-like eggs 10 millimeters in diameter. The eggs hatched five days after being laid, and in eighteen days a thousand young fry," about three inches long, left the nest They were then essentially like the adults. Many of the young were secured by Budgett immediately after they had left their nest, and "lived well on chopped-up worms." He tried to take some to England, but every one died as soon as they "got into colder climes."

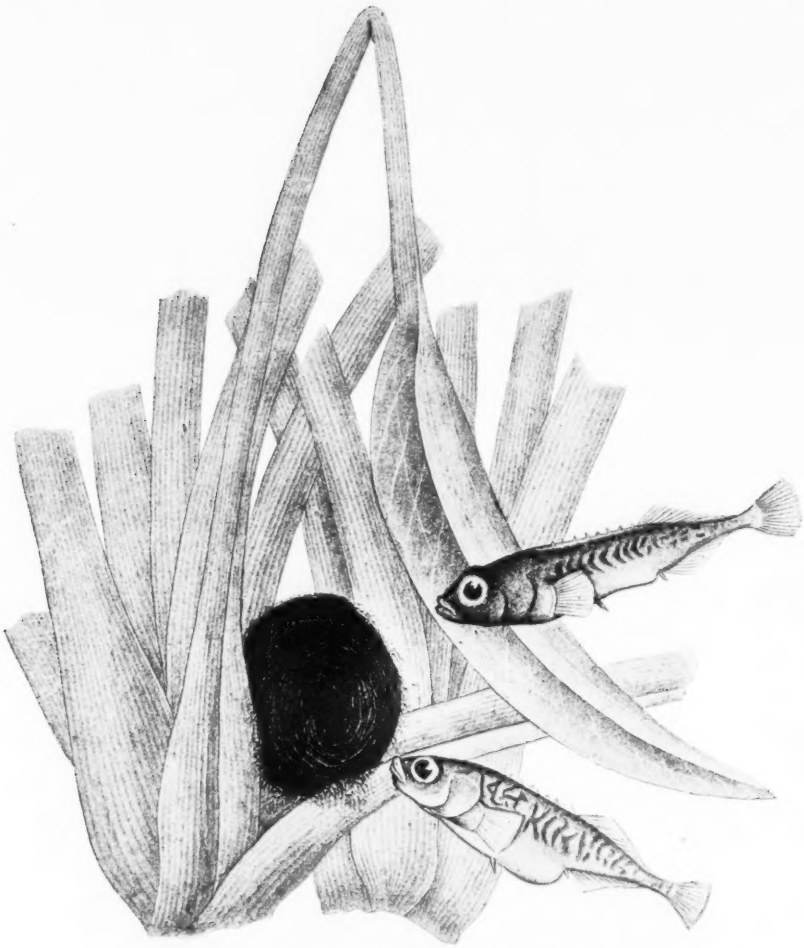
The native Africans "approach these nests with great caution, stating that the parent is at this time extremely fierce and has a very formidable bite."

THE STICKLEBACK

The stickleback of all fishes probably shows the greatest ingenuity and zeal in the protection of its offspring; but it is the male, and not the female, that exercises parental care; he it is that builds a nest that would do credit to a bird, and drives or entices the full female to enter into it and deposit her ripe burden. When a sufficient supply of eggs has been secured, the male closes the nest and remains in charge till the young have



Stickleback Male Rotating in His Nest to make it Tubular for the Female
After Coste



Nest of Ten-spined Stickleback.

Female preparing to enter a nest to lay her eggs. After Coste

reached a size which he considers to be sufficient to enable them to wander away and seek their own living.

The stickleback is very common in America and Europe, varieties of this tiny fish being found in almost every permanent body of water, however small.

One instance illustrative of their occasional extraordinary numbers has been often quoted, but is as apt now as ever. In 1776 Pennant claimed that "once in seven or eight years amazing shoals appear in the Welland" Canal "and come up the river in the form of a vast column. They are supposed to be the multitudes which have been washed out of the fens by the floods of several years and collected in some deep hole till, overcharged with numbers, they are periodically obliged to attempt a change of place. The quantity is so great that they are used to manure the land, and trials have been made to get oil from them. A notion may be had of this vast shoal by saying that a man employed by the farmer to take them has got for a considerable

time 4 shillings a day by selling them at a half penny a bushel."

This account has been quoted as unparalleled, but several notices in American publications come nearly, if not fully, up to it. In the Canadian Annual Report on Fisheries for 1863 (p. 61) it is reported that the three-spined stickleback or picassou was "caught in great quantities in the small rivers, brooks, and *barachois* of Magdalen Islands, where it is used as food for cattle and as manure," and that "400 barrels were caught" in 1862 "in the *barachois* of Basque Harbor" alone. Four hundred barrels were also caught in 1866 and sold as manure at 25 cents per barrel, but in 1867 the catch was smaller (150 barrels) and prices advanced to "1s. 3d. per barrel."

A FISH THAT BUILDS A COCOON FOR ITSELF

Dr Gill also describes a peculiar fish found in tropical Africa north of the Congo Basin and known as the *Protopterus annectens*. This fish lives mostly in shallow, muddy waters or swamps which dry up during the rainless season. When the water disappears the fish burrows down into the mud and builds around itself a sort of cocoon by means of a mucous which it discharges. In this cocoon it will live for months at a time in a semi-lethargic condition. It receives air to breathe through a tube which leads from the cocoon to the surface. When the dry season ends and the rain returns, the fish emerges from its hiding place. The naturalists have known for a good many years about this fish, but it was not until 1901 that Mr J. S. Blodgett succeeded in obtaining a number of the nests,

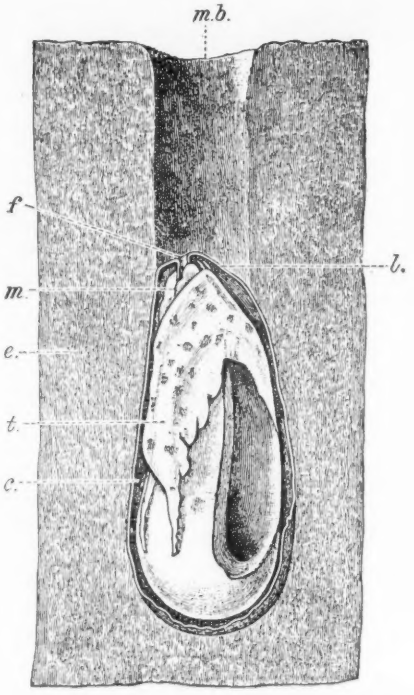


Diagram of the cocoon which a certain fish builds to retain moisture for itself in the dry season (see below). *c*, cocoon; *e*, earth; *f*, funnel leading to mouth of fish; *l*, lid; *m*, mouth; *mb*, mouth of burrow; *t*, tail. After Parker.

which he brought to England. The fish are quite large; all the males found by Mr Blodgett exceeded 18 inches in length. These fish are highly esteemed by the African negroes, who hunt for the cocoons in the dried-up swamps and carry them off for future use. The flesh is described as very soft and white.

Protopterus annectens. After Lankester

Illustration of the fish which builds a cocoon to protect itself. The fish averages about 16 inches

NOTES ON THE REMARKABLE HABITS OF CERTAIN TURTLES AND LIZARDS*

By H. A. Largelamb

THE ALLIGATOR SNAPPING TURTLE

THE alligator snapping turtle (*Macrochelys lacertina*) is found in the Mississippi River and the other rivers flowing into the Gulf of Mexico, all the way from Texas to Florida and as far north as Missouri.

Although turtles are not provided with teeth, the bite of this giant turtle may well be feared, for it is quite capable of snapping off a finger or hand at a single bite. It possesses a pair of keen-edge cutting mandibles and jaw muscles of great power. It snaps off a large section of a fish like a shad as cleanly as though removed with a cutting die. It is unable, however, to swallow its food unless its head is completely immersed. If kept in water too shallow for this, it would starve in the midst of plenty. It could take the food, but could not swallow it.

The alligator snapping turtle, when lying at the bottom of the muddy water it frequents, can hardly be distinguished from a great boulder stone embedded in the mud. It is provided with a very remarkable appendage, which it uses to entice fish right into its mouth. The appendage is found on the inside of the lower jaw, close to the region of the tongue. Mr Raymond Lee Ditmars, in his fascinating book upon Reptiles, says:

"This is a well-developed filament of flesh, white, and distinct from the yellowish mouth parts, and resembling a large grub to such a degree of nicety that the popular-minded observer, seeing the object in the reptile's mouth, would declare it to be the larva of some insect. More striking, however, is the reptile's power to keep this appendage in motion, giving it the aspect of crawling about in a small, circular course.

"With the mud-colored shell lying close to the bottom, the jaws thrown open to a great extent, this organ is put in motion. Every other portion of the creature is as motionless as a rock. In this position of rigidity the shell looks like a great, round stone, and blotches of fine waving moss intensify the deception; the big head looks like another stone, beneath which there is a cavern, and in this cavern crawls the white grub, to all appearances, an object dear to the hearts of finny wanderers. But woe to the luckless fish that swims within reach of those yawning jaws."

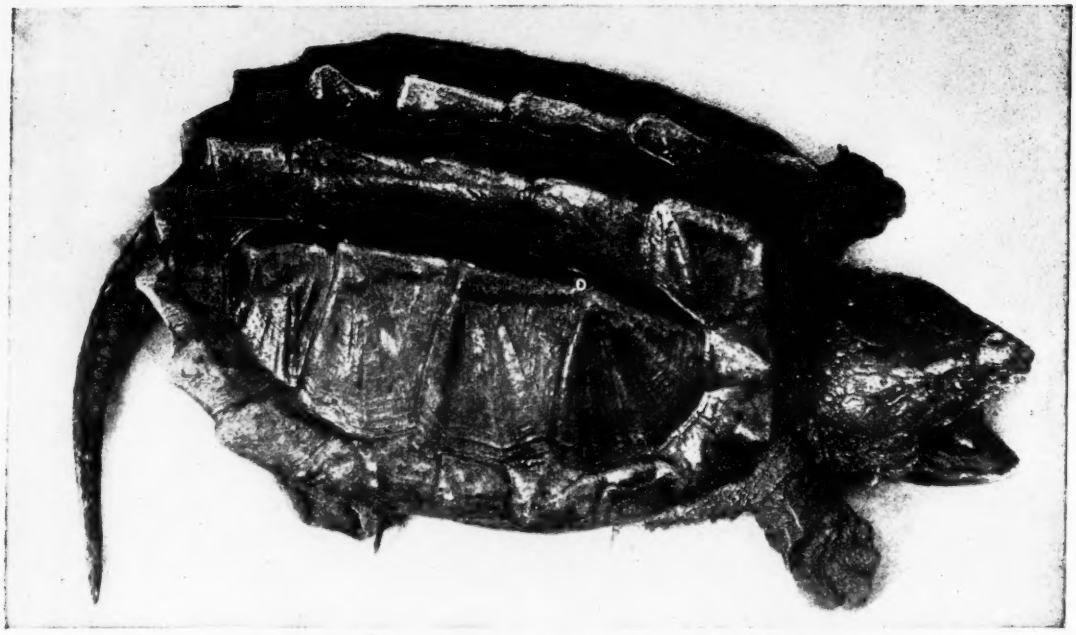
LIZARDS' TAILS

We are all more or less familiar with the difficulty of catching lizards without causing them to lose their tails. The tails come off on the slightest provocation. This decapitation—or, rather, decaudation—is not of so much consequence to a cold-blooded reptile as it would be to a mammal, like a dog or cat; for the lizard soon grows another tail, which, though it may not equal the original tail in length, is yet a good serviceable organ. How many times the tail may be removed and yet be replaced we do not know.

The removal of the tail is not always the result of violence, for some lizards, the plated lizards, for example, are able to discard the tail voluntarily in the face of an enemy. The abandoned tail acts as a decoy to the pursuer. The tail wriggles and writhes and thrashes about with such liveliness among the dead leaves into which it is thrown as to distract the attention of the pursuer, and thus the original owner escapes.

The glass "snake," which is really a lizard, although it has no feet, is unable to make much speed; and for this reason

* A review of "The Reptile Book," by Raymond L. Ditmars, Curator of Reptiles in the New York Zoölogical Park, with 8 plates in color and more than 400 photographs from life. Pp. 475. 10 x 8 inches. New York: Doubleday, Page & Co. 1907.

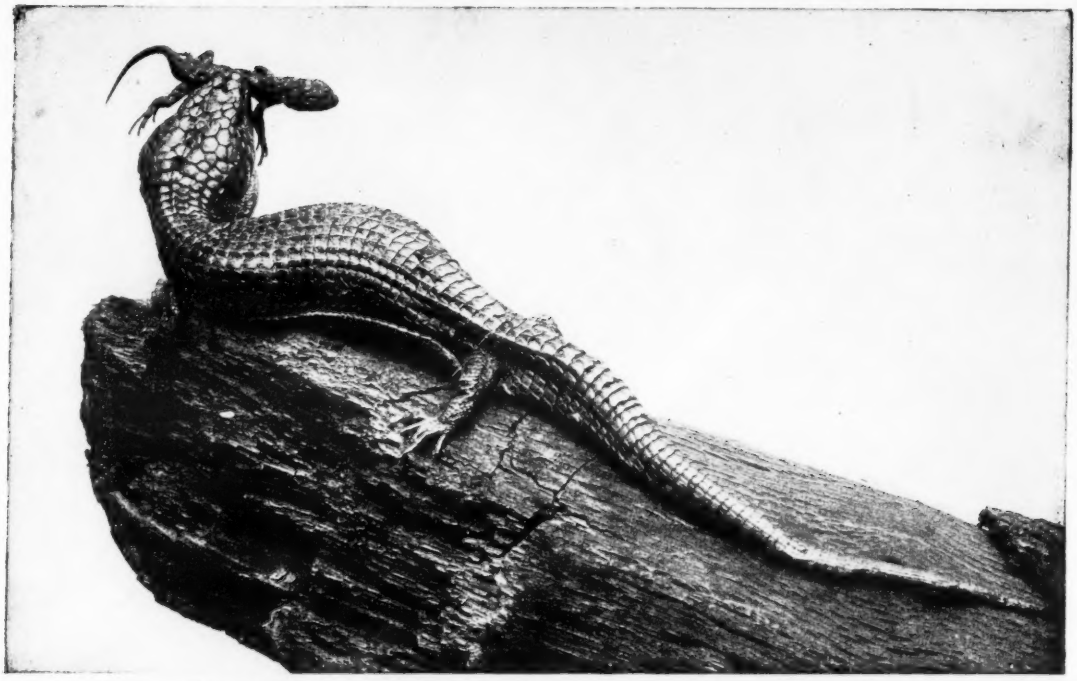


Alligator Snapping Turtle, *Macrochelys lacertina*

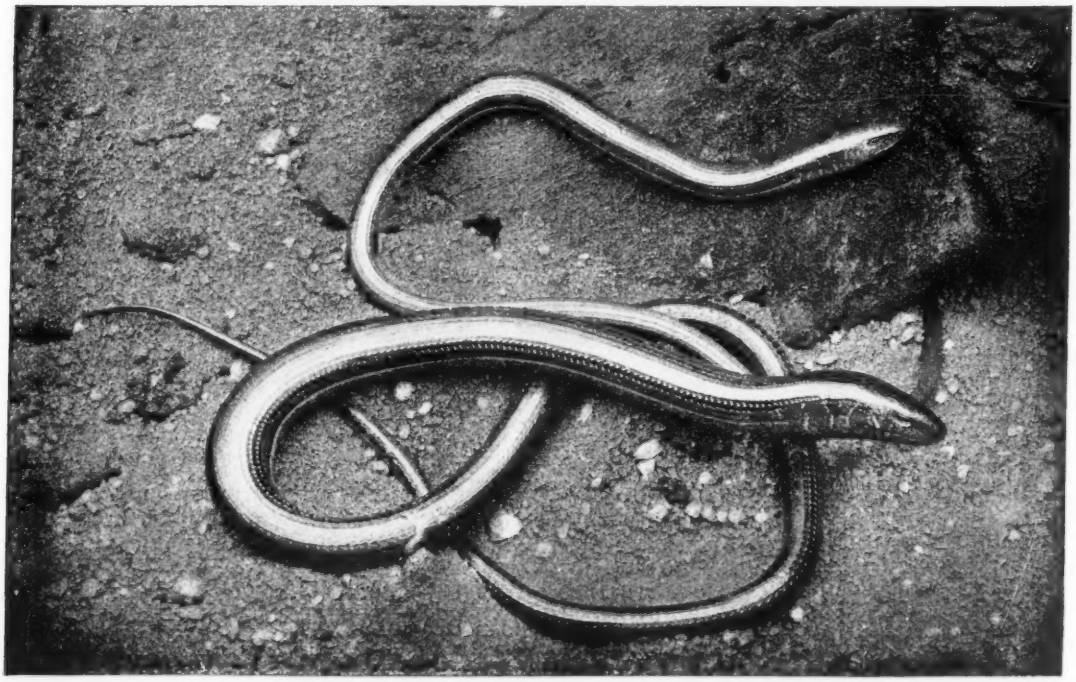
Distinguished from the common snapping turtle by the absence of the broad plates under the tail, the yellowish color, and much larger size. Reaches a weight of 140 pounds. Inhabits rivers emptying into the Gulf of Mexico

Head of the Alligator Turtle, *Macrochelys lacertina*

The jaws of a large specimen could readily amputate a man's hand or foot

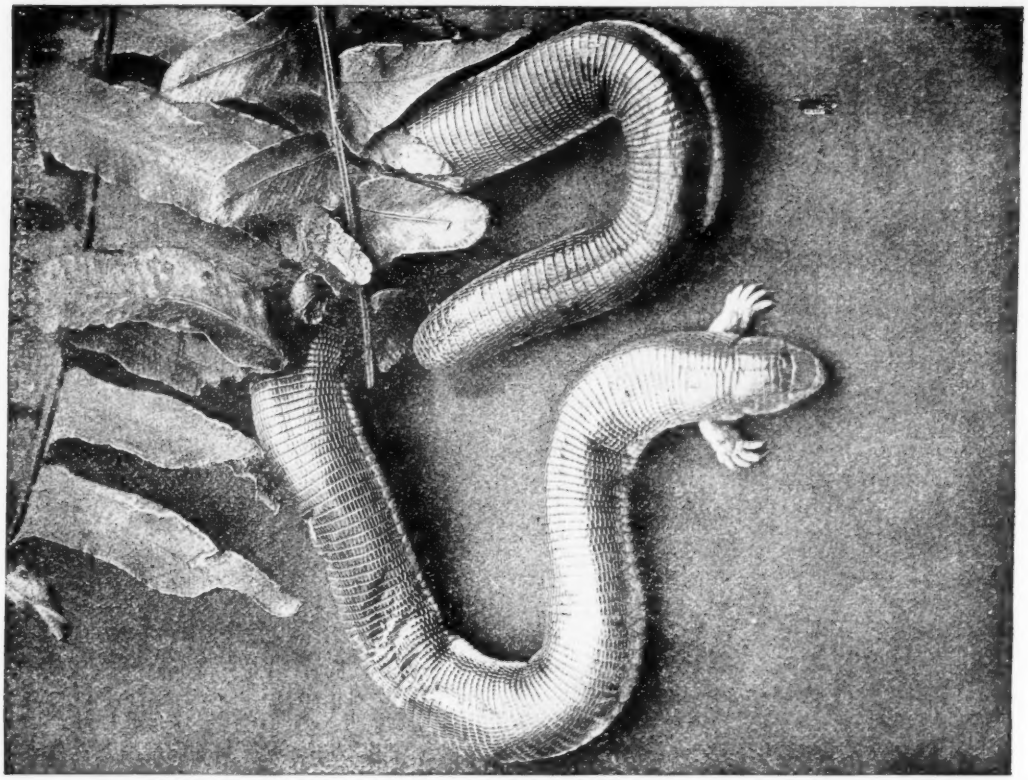


Plated Lizard, *Gerrhonotus imbricatus*—a Western Species



Glass "Snake," *Ophisaurus ventralis*

A snake-like representative of the *Anguidæ*, inhabiting the Southern States. Several very similar species are found in Europe and Asia



Two-footed Worm Lizard, *Lipes caniculatus*

Worm-like and practically blind, this degenerate lizard leads a subterraneous life, burrowing long tunnels, through which it moves backward or forward

it is very easily overtaken by its enemy, the king snake. As the pursuer catches up with his prey he grasps at once at the first part offered.

"There is a sudden twisting movement on the part of the glass 'snake,' and the victor finds that the smooth, scaly length he holds in his jaws is so vigorous that it requires much attention, for it twists and wriggles with great energy. Swallowing all his prey head first, the cannibal works his jaws along the victim to engulf it from such a position, when, after much maneuvering with the writhing quarry, the snake stops in some embarrassment. There is no head. The object that has engaged so much attention is simply the long tail of the lizard, and the abbreviated owner has glided to safety."

HORNED LIZARDS

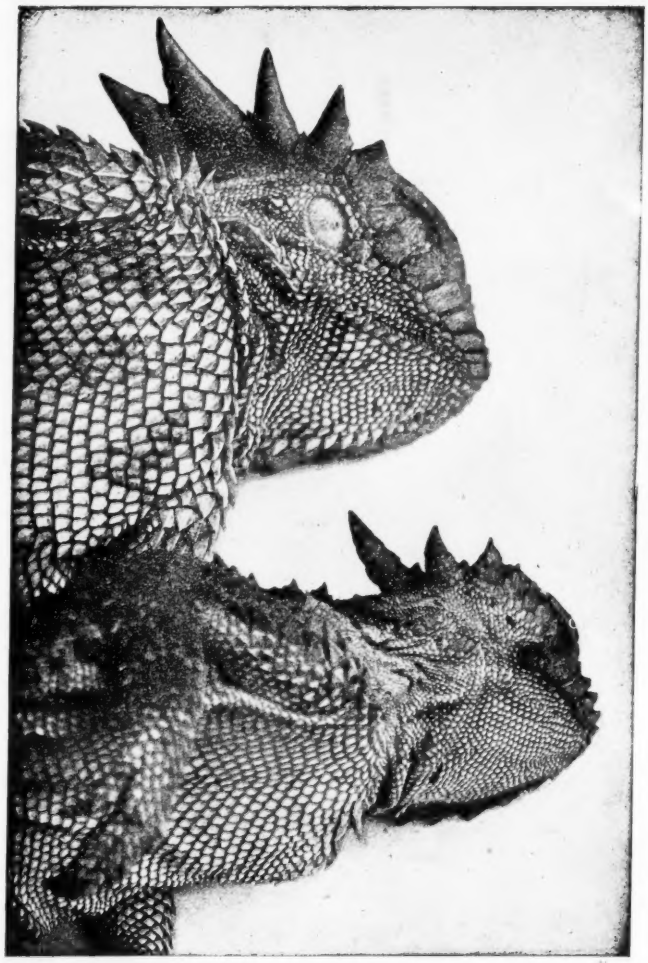
The expulsion of jets of blood from the corner of the eye is a remarkable habit sometimes attributed to horned lizards. We can hardly wonder that so eminent an observer as Raymond Lee Ditmars, Curator of Reptiles in the New York Zoölogical Park, after having examined several hundred specimens without observing the effect, should have become somewhat skeptical about the alleged habit. His skepticism, however, has been suddenly dispelled with a rather startling denouement.

Having received an unusually large and fat specimen of a Mexican horned lizard (*Phrynosoma orbiculare*), he photographed the specimen and then began to measure it.

"The latter process," he says, "seemed to greatly excite the creature. It finally threw the head slightly upward, the neck became rigid, the eyes bulged from the sockets, when there was a distinct sound like that produced if one presses the tongue against the roof of the mouth and forces a small quantity of air forward. This rasping sound, consuming but the fraction of a second, was accompanied by a jet of blood at great pressure. It hit the wall, four feet away, at the same level as that of the reptile. The duration of the flow of blood appeared to be about one and a half seconds, and toward its termination the force gradually diminished, as noted by a course of drops down the wall and along the floor to a position almost under the spot where the reptile had been held. The stream of blood seemed to be as fine as horse hair and to issue from the eyelid, which was momentarily much swollen.

"For some time after the performance the eyes were tightly closed and nothing could induce the lizard to open them. Within two minutes after it was placed on the ground the protruding aspect of the eyeballs and the swelling of the eyelids had disappeared.

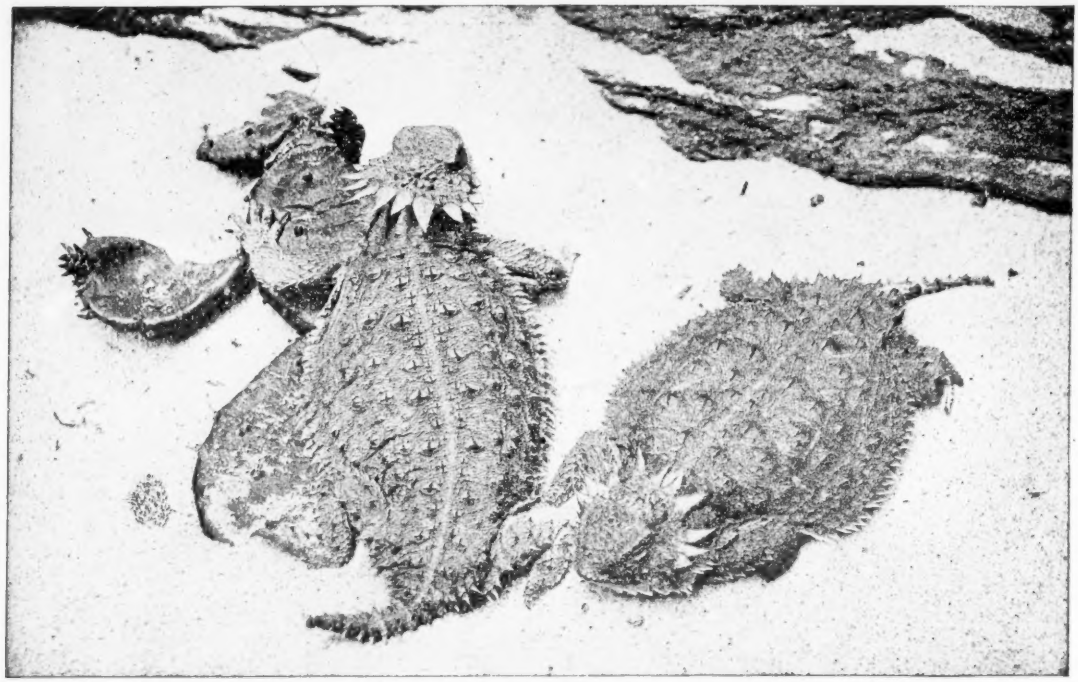
"Most surprising was the amount of blood expended. The wall and floor showed a course of thickly sprinkled spots about one-eighth of an inch in diameter. There were 103 of these spots."



Heads of Horned Lizards

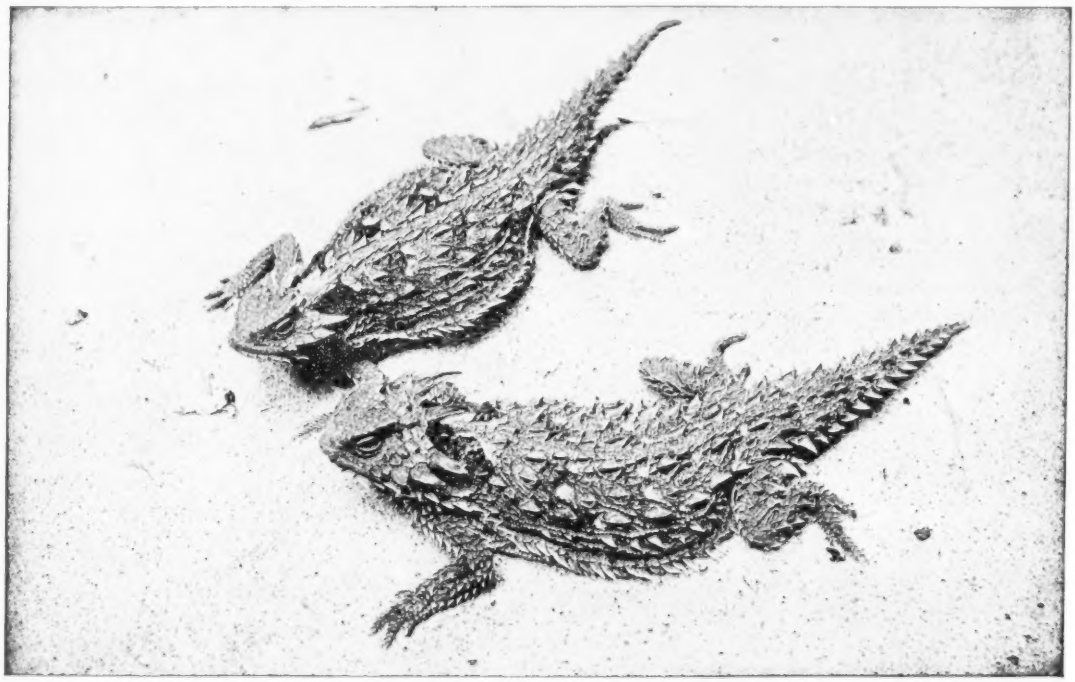
The above quotation is also taken from "The Reptile Book," by Raymond Lee Ditmars, published by Doubleday, Page and Company, 1907. This book is an admirably written and well illustrated work on the structure and habits of the Turtles, Tortoises, Crocodilians, Lizards, and Snakes which inhabit the United States and northern Mexico.

While thoroughly scientific in its treatment of the subject, the work is written largely in untechnical language and the illustrations are the best we have seen.



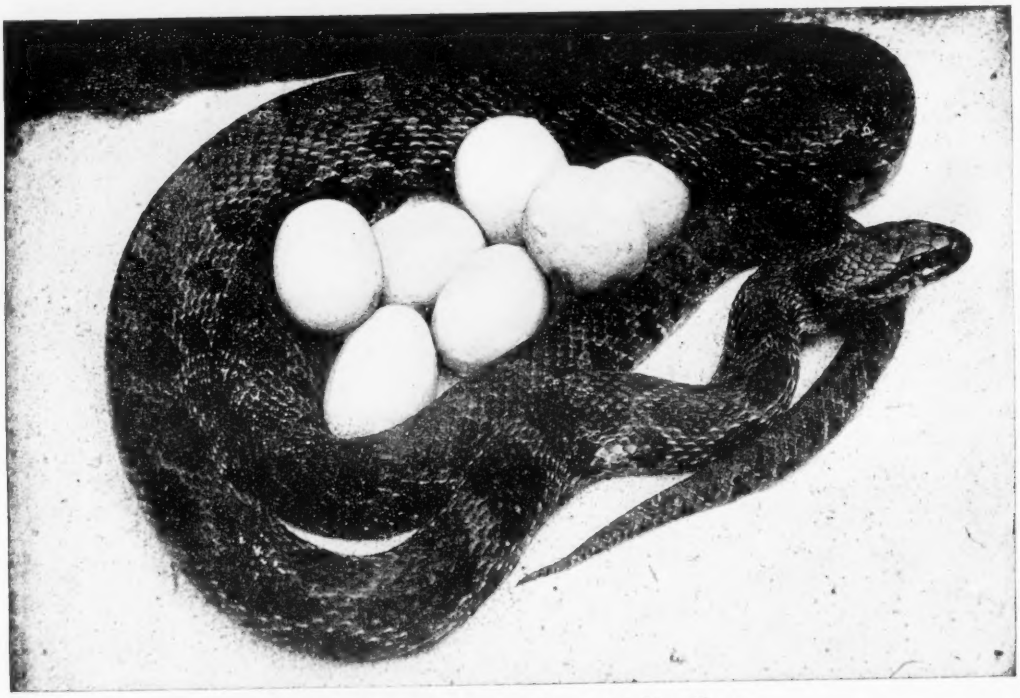
Regal Horned Lizard, *Phrynosoma regale*

A showy species of the southwestern deserts. The only member of its genus having four central occipital horns. These and the temporal horns produce the effect of a circlet or crown. The horns are often pinkish

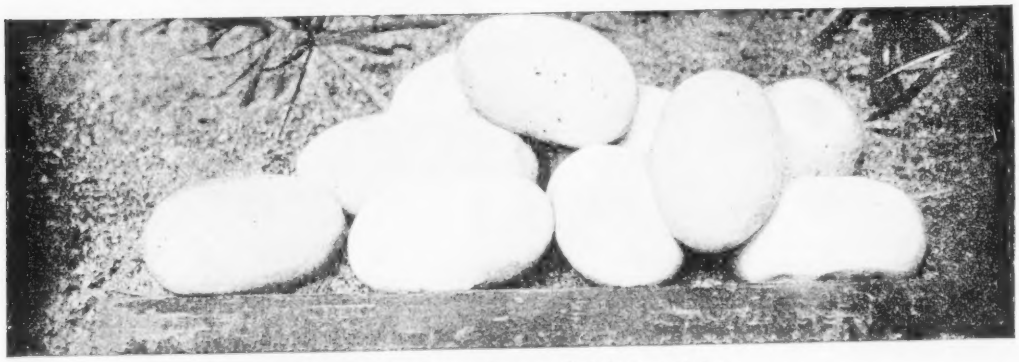


Pacific Horned Lizard, *Phrynosoma coronatum*

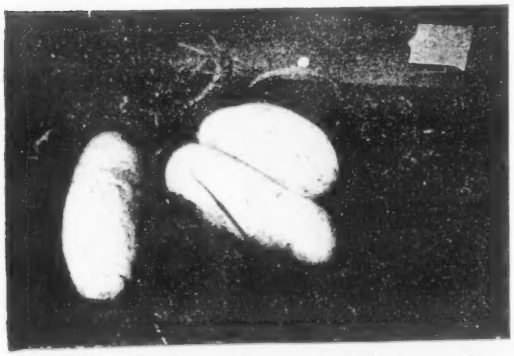
Most nearly allied to the Regal Horned Lizard, but differing in the more elongate body, the thicker and longer tail and in having only two occipital horns. Inhabits southern California and Lower California



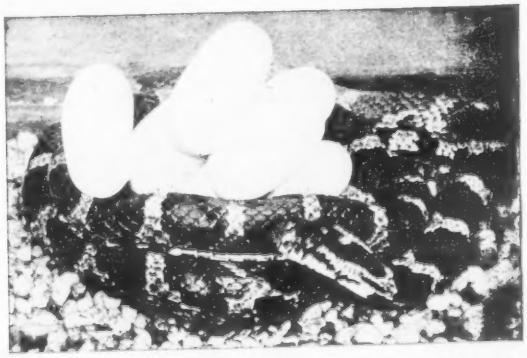
Fox Snake, *Coluber vulpinus*, and Her Eggs



Eggs of the Corn Snake, *Coluber guttatus*



Eggs of the Green Snake, *Liopeltis vernalis*



Milk Snake, *Ophibolus doliatus triangulus*, and Her Eggs

Breeding Habits of Snakes

COMMERCIAL AND FINANCIAL STATISTICS OF THE PRINCIPAL COUNTRIES OF THE WORLD

From "Statistical Abstract of the United States, 1906." By O. P. Austin, Chief U. S. Bureau of Statistics.

NOTE.—United States equivalents of the following monetary units: *Argentina:* Paper peso (1905)=42.5 cents. *Bolivia:* Boliviano (1905)=44 cents; (1906)=47.7 cents. *Brazil:* Milreis (1905–6)=30.4 cents. *China:* H. Tael (1905)=73.6 cents. *Costa Rica:* Colon (1905–6)=46.5 cents. *Greece:* Paper drachma (1905–6)=15.7 cents. *Haiti:* Paper peso (1905–6)=25 cents. *Honduras:* Silver peso (1904–5)=43 cents. *Nicaragua:* Peso curr. (1905)=17 cents. *Paraguay:* Paper peso (1906)=8 cents. *Portugal:* Milreis curr. (1905)=99.2 cents. *Salvador:* Peso (1905)=44.1 cents. *Siam:* Tical (1905–6)=30 cents. *Spain:* Peseta curr. (1906)=17.1 cents. *Turkey:* £T=$4.40.

Country.	Area.	Population.	Population per square mile.	Foreign Commerce.						
				Year.	Imports of Merchandise.	Imports from the United States.	Per cent imports from U. S.	Exports of Merchandise.	Exports to the United States.	Per cent exports to U. S.
	Sq miles.				Dollars.	Dollars.		Dollars.	Dollars.	
Argentina	1,135,840	5,678,000	5.00	1905	197,974,000	27,908,000	14.10	311,544,000	15,167,000	4.87
Australasia { Australia	2,972,573	4,048,000	1.36	1905	[1] 186,614,000	21,834,000	11.70	[1] 276,617,000	5,109,000	1.85
Australasia { New Zealand	104,751	889,000	8.49	1905	[2] 62,432,000	7,000,000	11.21	[2] 76,190,000	3,486,000	4.58
Austria-Hungary	241,333	47,355,000	196.22	1905	435,665,000	41,347,000	9.49	455,487,000	10,751,000	2.36
Austria	[3] 115,903	[3] 27,241,000	235.03	.....	.....	.....	.....	.....	.....	.....
Hungary	[3] 125,430	[3] 20,114,000	160.36	.....	.....	.....	.....	.....	.....	.....
Belgium	11,373	7,161,000	629.65	1905	585,603,000	46,748,000	7.98	446,439,000	17,813,000	3.99
Bolivia	729,000	2,180,000	2.99	1905	8,952,000	756,000	8.45	13,024,000	27,000	.21
Brazil	3,219,000	14,334,000	4.45	1905	144,775,000	14,961,000	10.33	216,668,000	89,109,000	41.13
Bulgaria	38,080	4,015,000	105.44	1905	23,594,000	274,000	1.16	28,556,000	272,000	.95
Canada	3,048,710	6,441,000	2.11	[4] 1906	283,282,000	168,798,000	59.59	218,182,000	66,353,000	30.41
Central America { Costa Rica	23,000	323,000	14.04	1905	5,239,000	2,706,000	51.65	8,138,000	3,836,000	47.14
Central America { Guatemala	46,774	1,804,000	38.57	1905	6,844,000	2,707,000	39.55	8,238,000	2,875,000	34.90
Central America { Honduras	46,250	745,000	16.11	1905	2,293,000	1,690,000	73.70	5,564,000	4,623,000	83.09
Central America { Nicaragua	49,200	500,000	10.16	1904	3,202,000	1,668,000	52.09	3,926,000	2,089,000	53.21
Central America { Salvador	7,225	1,007,000	139.38	1905	4,346,000	1,355,000	31.18	5,640,000	1,225,000	21.72
Chile	279,901	3,239,000	11.57	1905	71,868,000	7,129,000	9.92	103,223,000	15,693,000	15.20
China	4,277,170	433,553,000	101.36	1905	339,439,000	56,611,000	16.68	167,726,000	19,895,000	11.86
Colombia	504,773	4,000,000	7.92	1904	[5] 14,453,000	[6] 4,936,000	34.15	[5] 12,658,000	[6] 6,837,000	54.01
Cuba	43,000	1,573,000	36.58	1905	94,807,000	42,982,000	45.34	110,168,000	95,331,000	86.53
Denmark	15,360	2,574,000	167.58	1905	[7] 166,837,000	[7] 26,832,000	16.08	[7] 142,991,000	[7] 5,529,000	3.87
Ecuador	116,000	1,400,000	12.07	1905	7,657,000	2,210,000	28.86	9,035,000	2,468,000	27.32
Egypt	383,900	9,821,000	25.58	1905	106,591,000	2,411,000	2.26	100,641,000	6,218,000	6.18
France	207,054	39,300,000	189.81	1905	922,329,000	98,874,000	10.72	939,305,000	56,916,000	6.06
Algeria	184,474	5,232,000	28.36	1905	74,090,000	648,000	.87	44,151,000	313,000	.71
Tunis	51,000	1,820,000	35.69	1905	17,554,000	267,000	1.52	11,247,000	21,000	.19
French East Indies	461,196	18,346,000	39.78	1904	36,792,000	.....	.....	36,073,000	.....	.....
French colonies, not elsewhere specified	3,375,602	26,427,000	7.83	1904	42,654,000	2,997,000	7.03	36,337,000	305,000	.84
German Empire	208,830	60,478,000	289.60	1905	1,696,660,000	236,082,000	13.91	1,364,131,000	129,054,000	9.46
German colonies	1,025,829	12,632,000	12.31	1904	8,666,000	173,000	2.00	5,837,000	10,000	.17
Greece	25,014	2,434,000	97.31	1904	26,441,000	293,000	1.11	17,480,000	810,000	4.63

Haiti	10,204	1,347,000	132.01	1901	5,500,000	1,956,000	35.56	12,760,000	1,128,000	8.84
India, British	1,766,642	294,361,000	166.62	1905	338,750,000	4,992,000	1.47	513,563,000	31,505,000	6.13
Italy	110,646	33,604,000	303.71	1904	369,351,000	46,106,000	12.48	308,263,000	36,853,000	11.95
Eritrea (Massoua)	50,193	280,000	5.58	1904	1,501,000	29,000	1.93	543,000	.....	.....
Japan	147,655	47,975,000	324.91	1905	243,292,000	51,935,000	21.35	158,508,000	46,724,000	29.48
Formosa	13,458	3,059,000	227.30	1905	12,175,000	573,000	4.71	12,097,000	1,714,000	14.17
Kongo Free State	920,000	19,000,000	20.65	1905	3,875,000	6,000	.16	10,235,000	.....	.....
Korea	84,400	[8] 12,000,000	142.18	1905	15,916,000	985,000	6.19	3,438,000	.....	.....
Mexico	767,060	13,606,000	17.74	[4] 1906	[2] 109,884,000	[2] 72,509,000	65.99	[2] 135,027,000	[2] 92,633,000	68.60
Netherlands	12,563	5,592,000	445.12	1905	1,030,918,000	96,747,000	9.38	799,694,000	32,702,000	4.08
Dutch East Indies	736,400	35,736,000	48.53	1904	77,973,000	1,298,000	1.66	117,635,000	9,704,000	8.25
Norway	124,130	2,311,000	18.62	1905	83,706,000	2,157,000	2.58	50,631,000	1,186,000	2.34
Paraguay	157,722	636,000	4.03	1904	3,566,000	125,000	3.51	3,179,000	.....	.....
Persia	628,000	7,654,000	12.19	1904–5	26,943,000	118,000	.44	19,093,000	29,000	.15
Peru	713,859	4,500,000	6.30	1904	20,916,000	3,761,000	17.98	19,790,000	1,849,000	9.34
Portugal	36,038	5,162,090	143.24	1904	67,006,000	4,779,000	7.13	33,169,000	643,000	1.94
Portuguese colonies	806,746	7,270,000	9.01	1903	32,187,000	1,844,000	5.73	23,108,000	31,000	.01
Roumania	50,700	6,480,000	127.81	1905	65,145,000	.....	.....	88,221,000	.....	.....
Russia	8,660,395	141,000,000	16.28	1904	335,472,000	32,407,000	9.66	518,288,000	2,247,000	.43
Finland	144,255	2,857,000	19.81	1905	51,770,000	.....	.....	47,824,000	.....	.....
Santo Domingo	18,045	610,000	33.80	1905	2,737,000	1,961,000	71.65	6,881,000	4,484,000	65.16
Servia	18,630	2,689,000	144.34	1905	10,731,000	251,000	2.34	13,895,000	.....	.....
Siam	236,000	5,000,000	21.19	1905	[9] 17,404,000	[9] 277,000	1.60	[9] 29,043,000	.....	.....
Spain	194,783	18,618,000	95.58	1904	175,740,000	19,704,000	11.21	171,962,000	5,307,000	3.08
Sweden	172,876	5,261,000	30.43	1905	153,780,000	11,109,000	7.22	120,657,000	2,644,000	2.20
Switzerland	15,976	3,459,000	216.51	1905	266,311,000	10,986,000	4.13	187,079,000	24,134,000	12.90
Turkey	1,115,046	24,932,000	22.36	1900–1	104,903,000	[6] 260,000	.25	65,582,000	[6] 1,808,000	2.76
United Kingdom										
British colonies, not elsewhere specified	121,371	43,221,000	356.11	1905	[7] 2,749,669,000	[7] 562,436,000	20.45	1,605,053,000	116,387,000	7.25
	951,333	15,010,000	15.78	1904	[2] 501,956,000	[2] 37,753,000	7.52	[2] 440,692,000	[2] 36,688,000	8.33
United States	[10] 3,624,122	[10] 84,154,000	[10] 23.22	[4] 1906	[7] 1,226,554,000	.....	.....	1,717,953,000	.....	.....
Philippine Islands	115,000	7,635,000	66.39	[4] 1906	25,799,000	4,334,000	16.80	31,917,000	11,579,000	36.28
Porto Rico	3,435	[8] 1,000,000	.....	.....	.....	.....	.....	.....	.....	.....
Uruguay	72,210	1,038,000	14.37	1904	21,938,000	2,121,000	9.67	39,793,000	2,137,000	5.37
Venezuela	593,940	2,591,000	4.36	[4] 1906	8,676,000	2,622,000	30.22	15,630,000	4,862,000	31.11
Total	46,026,045	1,578,957,000	.....	.....	13,739,697,000	1,798,338,000	.....	12,496,419,000	1,031,113,000	.....
Total, exclusive of the commerce of the U. S.	.....	.....	.....	.....	12,513,143,000	1,798,338,000	14.37	10,778,466,000	1,031,113,000	9.57

[1] Exclusive of intercolonial commerce, but including bullion and specie.
[2] Including bullion and specie.
[3] Not included in total.
[4] Year ending June 30.
[5] Exports from and imports into principal countries in their trade with Colombia.
[6] Exports from the United States into and imports into the United States from the respective country.
[7] General trade.
[8] Estimated.
[9] Trade of Bangkok only.
[10] Including Alaska and Hawaii, but exclusive of Porto Rico; estimates of population furnished by the Census Bureau as per date June 1, 1906.

The Material History of the United States, from "Statistical Abstract of the United States." By O. P. Austin, Chief U. S. Bureau of Statistics

Year.	Population June 1.	GOVERNMENT FINANCE, PER CAPITA.							Production per capita of—		INTERNAL REVENUE.		Merchandise imported for consumption per capita.	CUSTOMS REVENUE.				POST-OFFICE DEPARTMENT.		PUBLIC SCHOOLS.		Year.
		Amount of money in the United States July 1.	Money in circulation July 1.	Debt, less cash in Treasury, July 1.	Year ended June 30.									Duty collected per capita.	Average ad valorem rate of duty.		Expenses of collecting.	Revenue per capita.	Expenditure per capita.	Population 5 to 18 years of age.	Expenditures per capita of population 5 to 18 years of age.	
					Interest on public debt.	Net revenue.	Net expenses.	Disbursements for pensions.	Gold.	Silver.	Collected per capita.	Expenses of collecting.			On dutiable.	On free and dutiable.						
		Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Per cent.*	*Dollars.*	*Dollars.*	*Per cent.*	*Per cent.*	*Per cent.*	*Dols.*	*Dols.*	*Millions.*	*Dollars.*	
1871..	39,555,000	18.75	18.10	56.81	2.83	9.69	7.39	0.84	1.11	0.60	3.62	5.30	12.65	5.12	43.95	38.94	3.18	0.51	0.62	12.3	5.62	1871
1872..	40,596,000	18.79	18.19	52.96	2.56	9.22	6.84	.74	.89	.72	3.22	4.36	13.80	5.23	41.35	37.00	3.21	.54	.66	12.6	5.90	1872
1873..	41,677,000	18.58	18.04	50.52	2.35	8.01	6.97	.70	.86	.86	2.75	4.69	15.91	4.44	38.07	26.95	3.76	.55	.70	12.8	5.95	1873
1874..	42,796,000	18.83	18.13	49.17	2.31	7.13	7.07	.71	.78	.86	2.39	4.40	13.26	3.75	38.53	26.88	4.49	.62	.75	13.1	6.11	1874
1875..	43,951,000	18.16	17.16	47.53	2.20	6.55	6.25	.68	.76	.69	3.52	3.89	11.97	3.51	40.62	28.20	4.47	.61	.79	13.4	6.23	1875
1876..	45,137,000	17.52	16.12	45.66	2.11	6.52	5.87	.63	.88	77	2.59	3.38	10.29	3.22	44.74	30.19	4.53	.63	.74	13.7	6.06	1876
1877..	46,353,000	16.46	15.58	43.56	2.01	6.07	5.21	.62	1.01	.80	2.56	2.99	9.49	2.77	42.89	26.68	4.96	.59	.72	14.0	5.67	1877
1878..	47,598,000	16.59	15.32	42.01	1.99	5.42	4.98	.56	1.08	.85	2.32	2.96	9.21	2.67	42.75	27.13	4.47	.62	.72	14.4	5.49	1878
1879..	48,866,000	21.15	16.75	40.85	1.71	5.60	5.46	.69	.80	72	2.32	3.10	8.99	2.73	44.87	28.97	3.96	.62	.69	14.7	5.18	1879
1880..	50,155,783	23.64	19.41	38.27	1.59	6.65	5.34	1.14	.72	.69	2.47	2.95	12.51	3.64	43.48	29.07	3.22	66	.73	15.1	5.17	1880
1881..	51,316,000	26.30	21.71	35.46	1.46	7.00	5.08	.98	.68	73	2.64	3.20	12.68	3.78	43.20	29.75	3.22	.72	.77	15.4	5.43	1881
1882..	52,495,000	26.85	22.37	31.91	1.09	7.68	4.91	1.03	.62	.78	2.79	2.80	13.64	4.12	42.66	30.11	2.95	.80	.77	15.7	5.67	1882
1883..	53,693,000	27.42	22.91	28.66	.96	7.41	4.94	1.13	.56	.74	2.69	3.06	13.05	3.92	42.45	29.92	3.07	.85	.81	16.0	6.05	1883
1884..	54,911,000	27.08	22.65	26.20	.87	3.36	4.44	1.04	56	.73	2.21	3.47	12.16	3.47	41.61	28.44	3.44	.79	.86	16.4	6.29	1884
1885..	56,148,000	27.38	23.02	24.59	.84	5.76	4.63	1.17	.57	.76	2.00	3.42	10.32	3.17	45.86	30.59	3.58	.16	.89	16.7	6.61	1885
1886..	57,404,000	27.20	21.82	22.34	.79	5.86	4.22	1.13	.61	.69	2.03	3.06	10.89	3.30	45.55	30.13	3.33	.77	.88	17.1	6.63	1886
1887..	58,680,000	27.84	22.45	20.03	.71	6.33	4.56	1.27	.56	.70	2.02	3.22	11.65	3.65	47.10	31.02	3.16	.83	.91	17.4	6.65	1887
1888..	59,974,000	28.20	22.88	17.72	.65	6.32	4.46	1.33	.55	.72	2.07	2.92	11.38	3.60	45.63	29.99	3.27	.88	.94	17.8	6.98	1888
1889..	61,289,000	27.06	22.52	15.92	.53	6.31	4.88	1.45	.53	.76	2.13	2.88	12.10	3.60	45.13	29.50	3.14	.92	1.01	18.2	7.28	1889
1890..	62,622,250	26.91	22.82	14.22	.47	6.43	5.07	1.71	.52	91	2.28	2.65	12.35	3.62	44.41	29.12	2.98	97	1.11	18.5	7.60	1890
1891..	63,844,000	26.28	23.42	13.34	.37	6.14	5.73	1.95	.52	.90	2.28	2.75	13.38	3.40	46.28	25.25	3.17	1.03	1.14	18.8	7.85	1891
1892..	65,086,000	26.92	24.56	12.93	.35	5.45	5.30	2.07	.51	.86	2.36	2.52	12.50	2.68	48.71	21.26	3.74	1.09	1.19	19.2	8.12	1892
1893..	66,349,000	26.21	24.03	12.64	.35	5.81	5.78	2.40	.54	.71	2.43	2.57	12.73	3.00	49.58	23.49	3.32	1.14	1.27	19.6	8.31	1893
1894..	67,632,000	26.69	24.52	13.30	.38	4.40	5.43	2.09	.58	.46	2.17	2.55	9.41	1.92	50.06	20.25	5.15	1.11	1.27	20.1	8.49	1894
1895..	68,934,000	26.39	23.20	13.08	.42	4.54	5.16	2.05	.68	.53	2.08	2.62	10.61	2.17	41.75	20.23	4.43	1.12	1.31	20.4	8.60	1895
1896..	70,254,000	25.62	21.41	13.60	.49	4.65	5.01	1.98	.76	.56	2.09	2.62	10.81	2.23	39.95	20.67	4.52	1.17	1.34	20.9	8.84	1896
1897..	71,592,000	26.62	22.87	13.78	48	4.85	5.11	1.97	.80	.45	2.05	2.46	11.02	2.41	42.17	21.89	4.01	1.15	1.34	21.1	8.89	1897
1898..	72,947,000	28.43	25.15	14.08	.47	5.56	6.07	2.02	.88	.44	2.34	2.17	8.05	1.99	48.80	24.77	4.78	1.22	1.39	21.6	9.01	1898
1899..	74,318,000	29.47	25.58	15.55	.54	6.94	8.14	1.88	.96	.44	3.68	1.59	9.22	2.72	52.07	29.48	3.57	4.28	1.41	21.9	9.13	1899
1900..	76,303,387	30.66	26.94	14.52	.44	7.43	6.39	1.85	1.04	.47	3.87	1.51	10.88	3.01	49.24	27.62	3.20	1.34	1.46	21.4	10.04	1900
1901..	77,647,000	31.98	27.98	13.45	.38	7.56	6.56	1.79	1.01	.43	3.96	1.43	10.58	3.01	49.64	28.91	3.23	1.44	1.52	22.0	10.35	1901
1902..	79,003,000	32.45	28.43	12.27	.35	7.11	5.96	1.75	1.01	.37	3.44	1.60	11.39	3.17	49.78	27.95	3.13	1.54	1.59	22.3	10.69	1902
1903..	80,372,000	33.40	29.42	11.51	.32	6.93	6.26	1.72	.92	.36	2.87	1.94	12.54	3.48	49.03	27.85	2.98	1.67	1.73	22.7	11.11	1903
1904..	81,752,000	34.29	30.77	11.83	.30	6.60	7.11	1.74	.98	.41	2.85	1.94	12.01	3.16	48.78	26.30	3.32	1.76	1.86	23.0	11.86	1904
1905..	83,143,000	34.68	31.08	11.91	.29	6.54	6.81	1.72	1.06	.41	2.82	1.85	13.08	3.11	45.24	23.77	3.48	1.84	2.05	23.4	12.46	1905
1906..	84,154,009	36.48	32.32	11.46	.28	7.02	6.72	1.68	1.14	.45	2.96	1.76	14.42	3.49	44.16	24.22	3.00	2.00	2.17	.....	.....	1906

The Material History of the United States, from "Statistical Abstract of the United States." By O. P. Austin, Chief U. S. Bureau of Statistics

Year.	EXPORTS OF DOMESTIC MERCHANDISE.						RETAINED FOR CONSUMPTION PER CAPITA.									RAW WOOL RETAINED FOR CONSUMPTION.		Tonnage of vessels. Annual increase or decrease (+ or −).	Imports and exports of merchandise by sea carried in American vessels.	Year.
	Total exports per capita.	Exports of products of manufacture, per cent of total exports.	Per cent of product exported.				Raw cotton.	Wheat and wheat flour.	Corn and corn meal.	Sugar.	Coffee.	Tea.	Distilled spirits.	Malt liquors.	Wines.	Total per capita.	Foreign.			
			Cotton.	Wheat and wheat flour.	Corn and corn meal.	Bituminous coal.														
	Dollars.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Pounds.*	*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pf. galls.*	*Gallons.*	*Gallon.*	*Pounds.*	*Per cent.*	*Per cent.*	*Per cent.*	
1871..	10.83	20.86	72.39	22.30	0.98	0.86	14.10	4.69	27.40	36.2	7.91	1.14	1.62	6.10	0.40	5.73	29.4	+ 0.85	31.9	1871
1872..	10.55	20.16	67.44	16.88	3.60	.58	11.10	4.79	21.09	40.4	7.28	1.46	1.68	6.66	.41	6.75	45.3	+ 3.62	29.2	1872
1873..	12.12	20.01	65.47	20.80	3.68	1.00	15.19	4.81	22.86	39.8	6.87	1.53	1.63	7.21	.45	5.67	33.2	+ 5.82	26.4	1873
1874..	13.31	18.81	70.03	32.54	3.86	1.29	13.60	4.46	20.95	41.5	6.59	1.27	1.51	7.00	48	4.81	17.5	+ 2.23	27.2	1874
1875..	11.36	20.42	70.69	23.60	3.53	.82	11.90	5.38	18.66	43.6	7.08	1.44	1.50	6.71	.45	5.28	22.1	+ 1.10	26.2	1875
1876..	11.64	20.14	70.75	25.34	3.86	.86	14.77	4.89	28.14	35.2	7.33	1.35	1.33	6.83	.45	5.21	18.3	−11.83	27.7	1876
1877..	12.72	24.45	68.97	19.73	5.66	1.18	14.03	5.01	26.13	38.9	6.94	1.23	1.28	6.58	47	5.16	16.3	− .86	26.9	1877
1878..	14.30	20.45	71.23	25.29	6.49	1.10	13.71	5.72	26.37	34.3	6.24	1.33	1.09	6.68	.47	5.28	16.9	− .70	26.3	1878
1879..	14.29	19.10	67.74	35.16	6.33	.85	15.90	5.58	26.61	40.7	7.42	1.21	1.11	7.05	.50	5.03	14.2	− 1.02	23.0	1879
1880..	16.43	14.78	65.73	40.18	6.43	.66	18.94	5.35	28.88	42.9	8.78	1.39	1.27	8.26	.56	6.11	34.9	− 2.43	17.4	1880
1881..	17.23	15.30	68.47	37.38	5.46	.50	19.64	6.09	31.64	44.2	8.25	1.54	1.38	8.65	.47	5.66	17.3	− .25	16.5	1881
1882..	13.97	22.09	67.23	31.82	3.71	.65	16.15	4.98	21.92	48.4	8.30	1.47	1.40	10.03	.49	6.36	19.0	+ 2.66	15.8	1882
1883..	14.98	19.95	67.20	29.33	2.58	.76	20.80	6.64	29.24	51.1	8.91	1.30	1.46	10.27	.48	6.62	18.7	+ 1.67	16.0	1883
1884..	13.20	21.51	67.56	26.49	2.99	.89	16.30	5.64	27.40	53.4	9.26	1.09	1.48	10.74	.37	6.85	20.6	+ .84	17.2	1884
1885..	12.94	20.67	68.96	25.86	2.95	.92	15.16	6.77	31.04	51.8	9.60	1.18	1.27	10.62	.39	6.69	18.0	− 12	15.3	1885
1886..	11.60	21.87	64.68	26.48	3.35	.82	19.59	4.57	32.60	56.9	9.36	1.37	1.28	11.20	.45	7.39	28.9	− 3.16	15.5	1886
1887..	11.98	21.21	68.71	33.66	2.48	97	16.84	5.17	27.68	52.7	8.53	1.49	1.21	12.23	.55	6.68	27.4	− 60	14.3	1887
1888..	11.40	22.53	65.83	26.23	1.74	.99	19.59	5.62	23.86	56.7	6.81	1.40	1.26	12.80	.61	6.31	28.9	+ 2.10	14.0	1888
1889..	11.92	22.72	69.33	21.31	3.57	.92	17.22	5.34	31.28	51.8	9.16	1.29	1.32	12.72	.56	6.33	31.8	+ 2.74	14.3	1889
1890..	13.50	21.18	68.15	22.31	4.85	1.33	18.50	6.09	32.09	52.8	7.83	1.33	1.40	13.66	.46	6.03	27.0	+ 2.71	12.9	1890
1891..	13.66	21.58	67.36	26.60	2.15	1.48	22.38	4.59	22.84	66.3	8.00	1.29	1.43	15.31	.46	6.44	30.8	+ 5.88	12.5	1891
1892..	15.61	18.02	65.13	36.88	3.72	1.62	24.58	5.94	30.48	63.8	9.67	1.38	1.49	15.17	.43	6.75	33.1	+ 1.71	12.3	1892
1893..	12.98	21.57	65.99	37.20	2.89	1.57	17.84	4.89	23.83	64.4	8.31	1.32	1.52	16.20	.48	7.10	35.7	+ 1.26	12.2	1893
1894..	12.85	23.33	71.20	41.47	4.11	1.90	16.45	3.44	22.96	66.7	8.30	1.36	1.34	15.32	.32	5.13	14.2	− 2.90	13.3	1894
1895..	11.51	25.84	69.83	31.46	2.36	2.24	22.75	4.59	17.18	63.4	9.33	1.40	1.14	15.13	.30	7.39	40.0	− 1.03	11.7	1895
1896..	12.29	29.89	65.00	27.07	4.70	1.86	18.67	4.85	29.18	62.5	8.11	1.33	1.01	15.84	.27	6.98	45.9	+ 1.47	12.0	1896
1897..	14.42	30.15	70.59	33.93	7.83	1.94	18.77	3.95	29.40	64.8	10.12	1.58	1.02	14.94	.53	8.40	57.8	+ 1.38	11.0	1897
1898..	16.59	26.81	67.82	40.91	11.14	2.04	25.76	4.29	23.19	61.5	11.68	.93	1.12	15.96	.28	5.44	32.8	− .40	9.3	1898
1899..	16.20	31.59	65.12	32.97	9.21	2.34	27.87	6.09	23.51	62.6	10.79	.98	1.18	15.28	.35	4.51	19.2	+ 2.41	8.9	1899
1900..	17.96	35.30	65.18	34.00	10.30	3.14	22.57	4.74	24.44	65.2	9.81	1.09	1.25	16.01	.39	5.72	34.4	+ 6.18	9.3	1900
1901..	18.81	31.88	62.87	41.36	8.62	3.04	25.94	3.95	24.77	68.7	10.48	1.14	1.31	16.20	.37	5.18	24.9	+ 6.96	8.2	1901
1902..	17.16	33.48	64.47	31.37	1 84	2.68	25.65	6.50	18.92	72.8	13.42	.94	1.36	17.49	.63	6.07	34.1	+ 4.95	8.8	1902
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1905..	17.94	40.98	61.55	7.99	3.66	2.69	33.07	6.15	28.59	70.5	12.17	1.23	1.45	18.50	.42	6.52	45.5	+ 2.62	12.1	1905
1906..	20.41	39.93	62.69	14.09	4.43	2.54	26.51	7.08	30.75	76.1	9.95	1.10	1.51	20.20	.55	5.88	39.6	+ 3.38	12.0	1906

USEFUL FACTS ABOUT THE COUNTRIES OF THE WORLD

ONE of the most useful annual volumes issued by the government is the "Statistical Abstract of the United States," which is published by the U. S. Bureau of Statistics. The volume for 1906, prepared by Hon. O. P. Austin, Chief of the Bureau, has just been distributed and is aptly described as a series of panoramic views of conditions in the United States from 1800 to the present time in area, population, production, commerce, circulation, wealth, intercommunication, publication, and education. The 700 pages of solid figures supply much more of actual information, both historical and as to the present conditions, than could be placed in any other form in equivalent space.

All kinds of puzzling questions will here find an answer. For instance, if the manufacturer of boots and shoes wants to know the countries in which American boots and shoes are being sold, and those in which the gains are most rapid, he will obtain the information from the abstract. Similarly, any merchant who desires to know the quantity and value imported or exported of any given article or class of articles in which he deals, may find not only the values of the imports or exports of the article in question, but the countries from which imported or to which exported and the growth in trade with that country year by year.

The American citizen who wants to know the sources from which the large and rapidly growing revenues of the Government are drawn and the purposes for which they are expended, here finds the detailed statement.

Through the courtesy of Mr Austin several tables showing the material progress of our country since 1870 are republished on the preceding pages.

The wealth of the United States, which in 1850 was set down at 7 billions of dollars, is given at 107 billions in 1904, the latest year for which figures are available; and the per capita wealth, which in 1850 was $307, was in 1904 $1,310. The public debt, which in 1864 was 2,675 million dollars, is now but 964 millions, and the per capita indebtedness which in 1864 was $76.98 is now but $11.46; while the annual interest charge, which was then $4.12 per capita, is now but 28 cents per capita. The money in circulation, which in 1800 was 26 million dollars, in 1850 278 millions, and in 1880 973 millions, was in 1906 2,736 millions; and the per capita circulation, which in 1800 was $5, and in 1850 $12, was in 1906 $32.32.

Bank deposits, for which no record is available earlier than in 1875, were in that year a trifle over 2 billion dollars, in 1900 7¼ billions, and in 1906 12¼ billions. Deposits in savings banks in 1820 amounted to 1 million dollars, speaking in round terms; in 1850 they had reached 43 millions, in 1875 924 millions, in 1900 2 1/3 billions, and in 1906 3¼ billions; while the number of depositors, which in 1820 was only 8,635, in 1850 251,354, in 1875 2,359,864, and in 1900 6,107,083, was in 1906 8,027,192, or nearly a thousand times as many as in 1820, while the deposits were more than 3,000 times as much in 1906 as in 1820.

Imports of merchandise, which in 1800 amounted to 91 million dollars, were in 1906 1,226 millions; while exports, which in 1800 were 71 millions, were in 1906 1,744 millions. The per capita of importations, which in 1800 amounted to $17.19, was in 1906 but $14.42, while the per capita of exportations, which in 1800 was $13.37, was in 1906 $20.41.

In the great manufacturing industries evidences of progress are equally apparent. The page devoted to this subject shows that the number of people employed in manufacturing has grown from

less than 1 million in 1850 to 5½ millions in 1905; the wages paid, from 237 million dollars in 1850 to 2,611 millions in 1905; and the value of products, from 1 billion dollars in 1850 to nearly 15 billions in 1905.

No nation in the history of the world has a record comparable with this.

FOUR PROMINENT GEOGRAPHERS

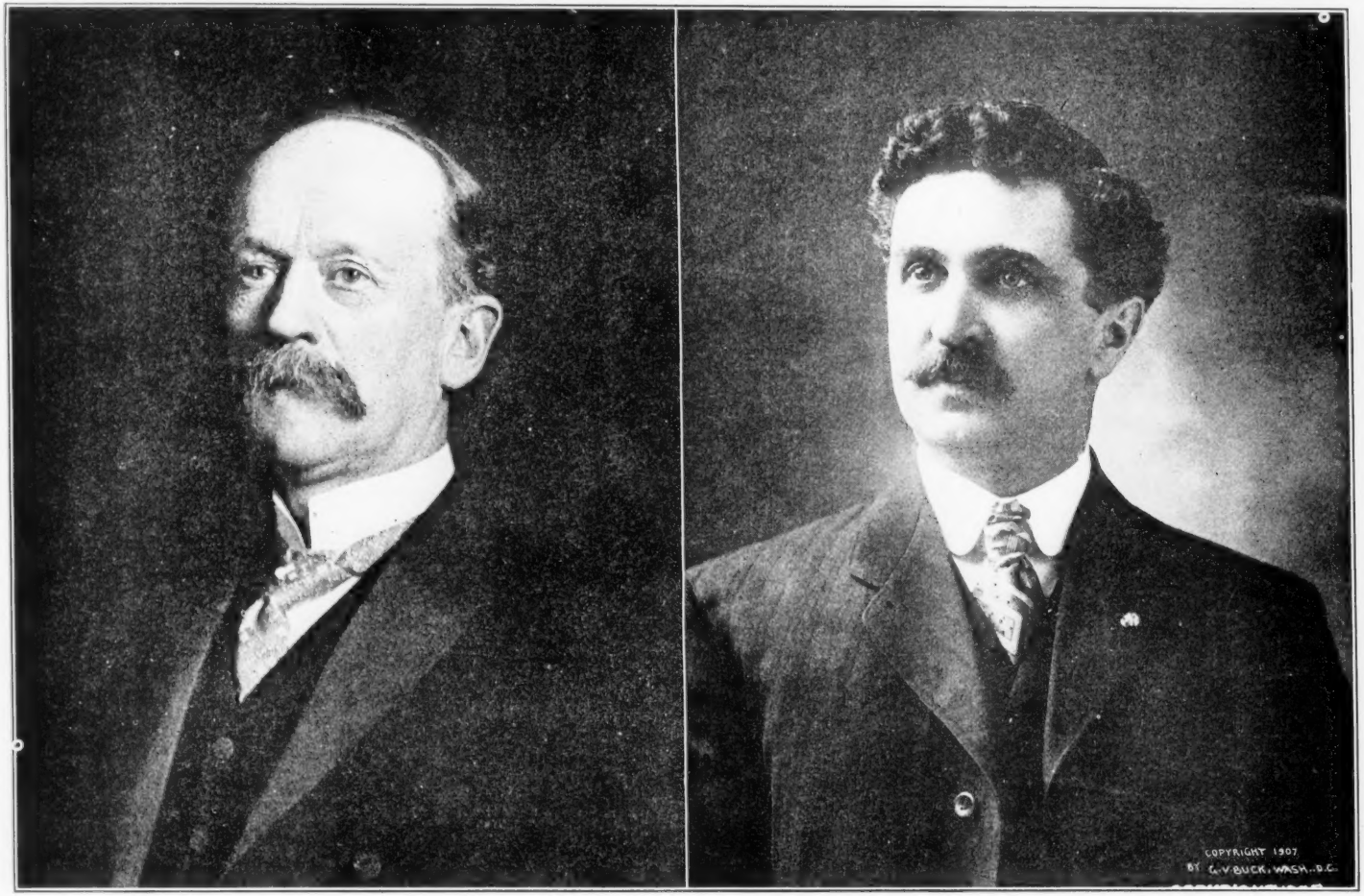
THE recent changes and promotions in the U. S. Geological Survey mark the close of one period and the entrance upon a new phase of existence. By the election of Mr Charles D. Walcott as Secretary of the Smithsonian Institution the former Director of the Geological Survey was promoted to the highest scientific position in the city of Washington. By the retirement of Mr Walcott from the directorship, the Geological Survey and the Reclamation Service lost their long-time leader, and these two organizations, connected through the individuality of Mr Walcott, were definitely separated. The change was made quietly and as a matter of evolution, Mr F. H. Newell, chief engineer of the Reclamation Service, becoming the Director of the organization, being succeeded by Mr Arthur P. Davis, who now is chief engineer.

The directorship of the Geological Survey has been filled by the designation of Mr George Otis Smith, one of the younger geologists, who has shown unusual ability, not only in scientific work, but in the tactful handling of business affairs.

Mr Smith was born in 1871 in Maine, and is a graduate of Colby College and of Johns Hopkins University, from which he received the degree of Ph. D. in 1896. During his connection with the U. S. Geological Survey as a geologist for the past ten years, he has worked in Michigan, Washington, Utah, North Carolina, the New England States, New Jersey, and Pennsylvania. He is the author of several geologic folios and monographs published by the Survey and of numerous contributions to technical journals. His work has been typical of the object for which the U. S. Geological Survey is maintained, namely, the application of the highest scientific training to obtain results of practical value to the public.

The history of the growth of the Reclamation Service from the Geological Survey is an illustration of the development of scientific investigation into practical operation. In the early eighties Major John W. Powell agitated the question of a thorough scientific investigation of the water resources of the West, and in 1888 he, as Director of the Geological Survey, was authorized by Congress to investigate the extent to which the arid region might be reclaimed by irrigation. This work was carried on systematically, under his direction, through the topographic and hydrographic surveys of the Geological Survey.

Upon the retirement of Major Powell and the succession of Mr Walcott, this work was continued with renewed vigor, and a large amount of information was collected as to the reservoir sites, the catchment areas of streams, and the amount of water which would be available for use at various points. As a result largely of this careful scientific investigation, Congress in 1902 took up and passed the so-called Newlands bill, setting aside the proceeds from the disposal of public lands to the construction of works of reclamation. The work was put in charge of the Secretary of the Interior, who naturally turned it over to the Director of the Geological Survey. He in turn intrusted it to the men who had been making scientific examination and studies through many years. They con-



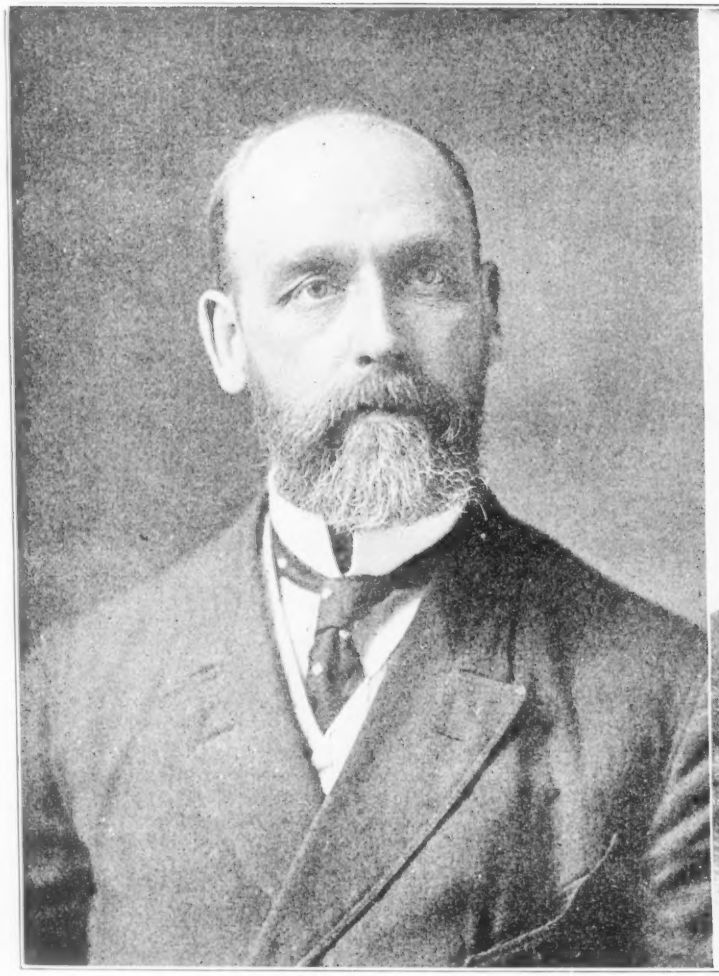
Charles D. Walcott

Secretary Smithsonian Institution. For thirteen years the Director of the U. S. Geological Survey

George Otis Smith

The new Director of the U. S. Geological Survey

The U. S. Geological Survey is the largest and most practical map-making institution in the world



Frederick Haynes Newell

Director of the U. S. Reclamation Service

Arthur P. Davis

Chief Engineer of the U. S. Reclamation Service

The United States government, through its Reclamation Service, is investing $12,000,000 annually in reclaming arid land, thereby creating the greatest irrigating works in the history of the world

tinued these studies, and out of them developed definite plans for the construction of large works, and began the building of these with the funds furnished through the terms of the reclamation act. There thus took place from 1902 a rapid change in character of the work, and the researches of the Geological Survey became almost overshadowed by the great operations of the Reclamation Service. The latter was at no time connected with the Geological Survey, as such, but from the fact that the Director of the Geological Survey was also the Director of the Reclamation Service, the two bodies have frequently been confused. The Reclamation Service was an offshoot or development of the Hydrographic Branch of the Geological Survey, the principal men of that branch, Mr Newell and Mr Davis, becoming the leaders in the Reclamation Service.

With the retirement of Mr Walcott from the directorship, the connection, which had been growing less and less, was finally terminated on March 9, 1907, by the designation of Mr Newell as Director. With the experience gained through nearly five years, the Reclamation Service is now in a condition to stand alone.

The period of survey and examination of the Reclamation Service has already passed and the principal efforts are being devoted to the construction of great works. The third period of its existence—that of operation and maintenance—has already been entered upon, and water is being diverted during 1907 to about 200,000 acres of agricultural land scattered throughout the western part of the United States. The expenditures have been made at the rate of one million and a half dollars per month, and in this regard the Reclamation Service has reached and passed the period of maximum activity. Henceforth the expenditures will decline somewhat, and it is expected that during 1907 the total expenditure will be about $12,000,000, and in 1908 about $7,000,000; so that by 1909 about $40,000,000, in round numbers, will have been invested in revenue-producing works.

The engineering features of the Reclamation Service have been placed under the charge of Mr Arthur P. Davis, who was for many years the assistant chief engineer and principal field man in direct contact with all of the engineering features. The Director, Mr Newell, will give his personal attention to matters of general policy, cost of the works, and especially to the problems of operation and maintenance. Upon this latter depends the future success of the reclamation act, as it is essential to obtain from the completed works the cost of construction and to invest it again in other large projects.

NOTES

AT a recent meeting of the Council of the Geographical Society of Paris, Mr Henry Gannett, Vice-President of the National Geographic Society and Chief Geographer of the United States Geological Survey, was unanimously elected an honorary corresponding member. The Geographical Society of Paris was founded in 1821 and is the oldest geographical organization in the world It has fifteen honorary corresponding members, among whom are included Dr Nansen, Sir John Murray, Prof. Albrecht Penck, and three Americans, Major General A. W. Greely, U. S. Army; Commander Robert E. Peary, U. S. Navy, and Prof. William M. Davis, of Harvard University.

The July number of the NATIONAL GEOGRAPHIC MAGAZINE will contain a map of the North Polar regions in seven colors, 18 x 18 inches, prepared by the Editor, Gilbert H. Grosvenor. The map will show all discoveries to date and will contain inserts of the Smith Sound region, of Franz Josef Land, and of Spitzbergen. The number will also contain several articles summarizing recent explorations in the Far North.

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